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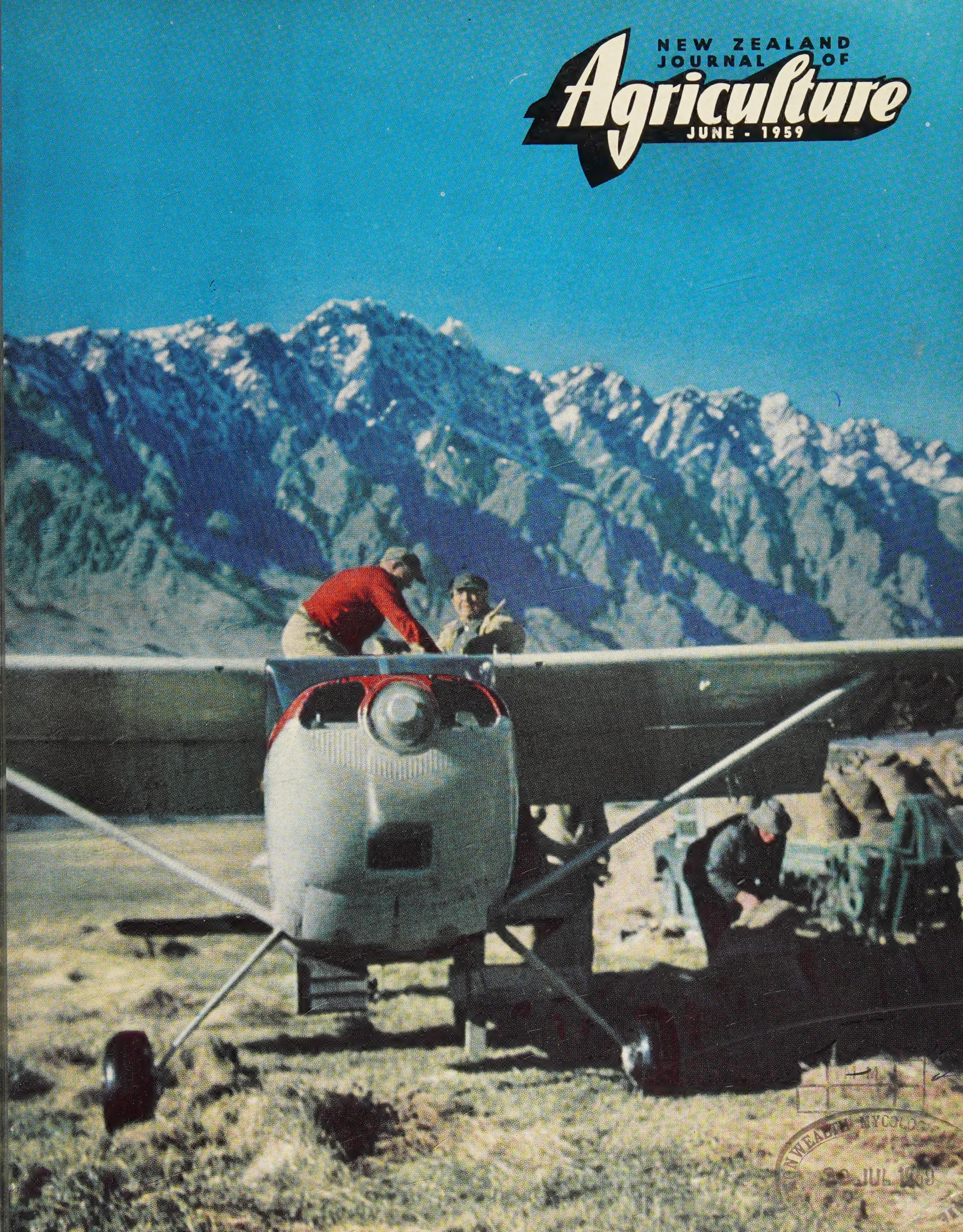

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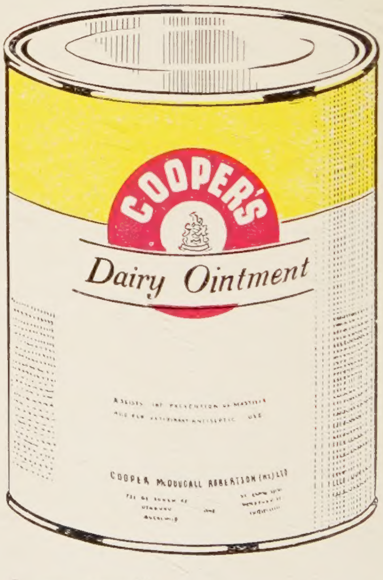

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[*D. G. Jardine photo*

A light aircraft being loaded below the Remarkables with poisoned bait for spreading against rabbits in the Lake Wakatipu district is the subject of this month's cover. Since its introduction as a game animal in the early days of settlement last century the rabbit has cost New Zealand dearly in damage to grassland and crops, but the numbers of the pest have declined sharply in the last decade through the vigorous "killer" policy implemented by rabbit boards. Many districts have now been virtually cleared of rabbits and the aeroplane with its rapid spread of baits over wide areas has enabled the campaign of extermination to be taken to the furthermost back country.

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New Zealand's Export Trade in Meat

▲ North Island fat lamb country. In New Zealand meat production is an integral part of sheep farming, and . . .

By J. V. WHITE, Rural Economist, and J. B. QUIGG, Investigating Officer, Department of Agriculture, Wellington

THE income earned by New Zealand from the sale of meat overseas reached the record sum of £84.6 million during 1958. This is a reflection of the favourable meat prices that have prevailed in world markets for some time, and is in sharp contrast to the position in 1956. The decline in meat prices in that year was one of the principal reasons for the combined Government-producer trade mission to the United Kingdom in April 1957. These circumstances demonstrate the importance to the New Zealand economy of the export trade in meat and also the uncertainties associated with the marketing overseas of our principal export commodities. This article traces briefly the history of New Zealand's meat exports and comments on future market prospects. Reference is also made to meat production in this country, because a thorough understanding of marketing problems is not possible without some knowledge of productive processes and other factors influencing output.

▼ . . . it is only on high country properties, mainly in the South Island, that sheep, such as these Merinos, are kept principally for their wool.

New Zealand chilled beef displayed for sale at Smithfield Market in London. The world import trade in meat is dominated by the United Kingdom, which takes about two-thirds of the total, including most of New Zealand's production (71.1 per cent in 1957-58).

PRODUCTION

MEAT production in New Zealand is an integral part of sheep farming, and it is only on high hill country properties, which are mainly in the South Island, that sheep are kept principally for their wool.

Table 1 shows that:

(a) There has been a fourfold increase in production over the past 50 years.

(b) Production has more than doubled since the 1920s.

(c) There has been a very rapid increase in production since 1954, and practically the whole of the total increase of over 100,000 tons has been contributed by beef and lamb.

(d) Production of mutton has been virtually static since 1920 and of pig meat since 1935.

Up to 1920 expansion was due largely to new land development, but since then it has been due primarily to greater intensification of farming. The fact that in 1921 the area of land under occupation and the area in sown grasses and annual crops (43.5 million acres and 18.2 million acres respectively) were virtually the same as today emphasises the important part played by scientific advances and improved techniques in the development of the meat industry.

EXPORTS

Exports of meat from New Zealand during selected years are given in Table 2.

TABLE I—ESTIMATED MEAT PRODUCTION IN NEW ZEALAND
(000 tons, bone-in weights)

Year ended 30 September	Beef	Veal	Mutton	Lamb	Pig meats	Offal	Total
1905	44.5	0.9	70.2	37.8	8.0	1.1	162.5
1910	85.2	1.1	94.7	58.3	9.1	3.0	251.4
1915	97.8	2.6	122.5	68.5	8.9	5.1	305.4
1920	110.3	3.0	147.1	50.7	10.2	7.1	328.4
1925	126.9	5.0	89.4	78.4	16.0	8.6	324.3
1930	89.5	10.0	109.2	109.8	24.4	10.9	353.8
1935	129.8	18.4	88.0	119.6	38.8	13.8	408.4
1940	163.1	18.4	124.2	161.8	44.1	18.9	530.5
1945	163.5	16.8	126.0	172.4	40.2	20.7	539.6
1950	164.2	21.2	131.2	200.6	38.9	21.3	577.4
1952	173.2	18.9	153.7	194.1	38.9	23.4	602.2
1954	178.1	20.7	129.4	198.4	37.7	24.2	588.5
1956	224.8	24.8	141.0	210.7	40.4	28.4	670.1
1958*	253.7	24.0	121.3	233.0	37.3	31.5	700.8

* Provisional

Sources: 1905-1945 and 1958, Department of Agriculture; other years, Department of Statistics

TABLE 2—EXPORTS OF MEAT FROM NEW ZEALAND
(000 tons)

Type and country of destination	1931	1936	1941	1946	1951	1953	1955	1957	1958
Beef:									
United Kingdom	17.3	36.3	25.1	53.7	32.4	36.2	64.5	48.1	11.4
Other	0.3	0.5	13.3	1.3	3.9	4.2	30.3	56.9	94.0
Total	17.6	36.8	38.4	55.0	36.3	40.4	94.8	105.0	105.4
Veal:									
United Kingdom	5.0	5.7	0.9	6.5	6.4	0.7	6.4	4.6	1.4
Other	0.9	—	0.2	—	0.2	3.3	4.0	5.7	8.6
Total	5.9	5.7	1.1	6.5	6.6	4.0	10.4	10.3	10.0
Mutton:									
United Kingdom	52.9	44.2	33.1	78.2	47.0	71.6	48.5	48.2	43.4
Other	—	—	1.5	0.1	2.2	1.0	15.1	4.5	8.5
Total	52.9	44.2	34.6	78.3	49.2	72.6	63.6	52.7	51.9
Lamb:									
United Kingdom	120.2	130.1	154.0	173.4	158.6	177.5	201.2	194.4	208.8
Other	—	0.1	0.6	—	0.9	2.0	2.6	2.8	8.9
Total	120.2	130.2	154.6	173.4	159.5	179.5	203.8	197.2	217.7
Pig meat:									
United Kingdom	5.9	30.2	24.5	9.2	7.6	11.8	7.3	3.3	2.9
Other	—	0.1	0.1	0.1	0.7	1.0	2.2	1.9	1.6
Total	5.9	30.3	24.6	9.3	8.3	12.8	9.5	5.2	4.5
Edible offal*:									
United Kingdom	1.9	7.3	10.6	11.6	12.2	12.6	14.0	14.8	13.2
Other	0.2	0.1	0.3	0.1	0.6	0.8	1.7	2.1	1.8
Total	2.1	7.4	10.9	11.7	12.8	13.4	15.7	16.9	15.0

* The figures shown for the years 1931 to 1946 inclusive are for other frozen meat excluding poultry, rabbits, and hares.

Sources: Statistical reports on the External Trade of New Zealand, Customs Department.

Table 2 brings out clearly:

(a) The progressive increase in exports of lamb, culminating in exports in 1958 of 218,000 tons, a quantity which is 81 per cent above that for 1931.

(b) The decline in the exports of pig meat from the substantial quantity of 30,000 tons shipped in 1936.

(c) The tendency for mutton exports to decline during the past decade. This trend is associated with the build-up of flocks in the interests of higher lamb output.

(d) The very substantial increase in beef exports since 1953. In that year the ratio of exports of lamb to beef was more than 4 to 1; in 1958 it was about 2 to 1.

Table 2 also emphasises New Zealand's dependence on export markets for the sale of meat (on a quantity basis about two-thirds of total production is exported) and the dominant place occupied by the United Kingdom as a market.

Lamb and Mutton Exports

A number of factors have favoured growth of the meat trade with Britain. The opening up of the virgin lands of New Zealand, which were eminently suited to livestock production, coincided with the rapid development of a wide range of industries and a marked increase in population in the United Kingdom. These factors, reinforced by improvement in sea transport and the close personal ties existing between the peoples of the two countries, made the development of trade natural and mutually advantageous.

Further, the United Kingdom has been a sheep-rearing country for centuries and her people have developed a taste for mutton and lamb. This fact has had an important influence on the development of our fat lamb industry and, in broad terms, the farm management pattern has been one of raising store sheep on hill country, the sale of the older Romney ewes to farmers occupying the flatter areas, and the mating of these ewes with Southdown rams. The resulting lambs are of the nuggety type which kill out at 30 to 36 lb and which are so popular on the United Kingdom market.

Beef Exports

Until recent years New Zealand's export trade in beef was more or less static. Some of the reasons for this were:

(a) Beef cattle were not accorded the same attention as sheep and were used mainly to provide meat for the local market and to maintain sheep pastures in good condition by trampling fern and keeping down rank growth.

(b) Frozen beef was not very popular in the United Kingdom and could not compete readily with the United Kingdom's own production or with chilled beef from Argentina.

(c) The production of good pasture-fed beef requires land of a quality suited to dairy and fat lamb production, and the returns from beef alone generally compared unfavourably with those from lamb and wool combined.

The rise in beef exports in very recent years has been stimulated by the strong demand for New Zealand beef particularly of the boneless variety, in the United States of America and the consequent improvement in the financial return to the producer.

OVERSEAS MARKETING

World Trade in Meat

Meat is produced principally for domestic consumption and only about 6 per cent of world output enters into international trade. About three-quarters of all meat exports come from five countries. In order of importance these are Argentina, New Zealand, Denmark, Australia, and the Netherlands. The import trade is dominated by the United Kingdom, which takes about two-thirds of the total. Next in importance as importers are the United States and the Western European countries such as Italy, Western Germany, and France.

The principal class of meat in world trade is beef and veal and this trade continues to expand. For instance, between 1953 and 1957 the total exports of beef and veal by 16 countries increased from 485,000 tons to 921,000 tons or 90 per cent. Over the same period mutton and lamb exports by a representative group of 10 countries fell from 382,000 tons to 359,000 tons. These few statistics highlight the problem which faces New Zealand of disposing of a rapidly increasing quantity of sheep meats in world markets where an increasing proportion of the demand is for beef.

Mechanics of Marketing

The export of New Zealand meat is in the hands of individual traders. The greater part of the trade is carried out by large companies which have direct links with overseas meat concerns. This situation has some advantages:

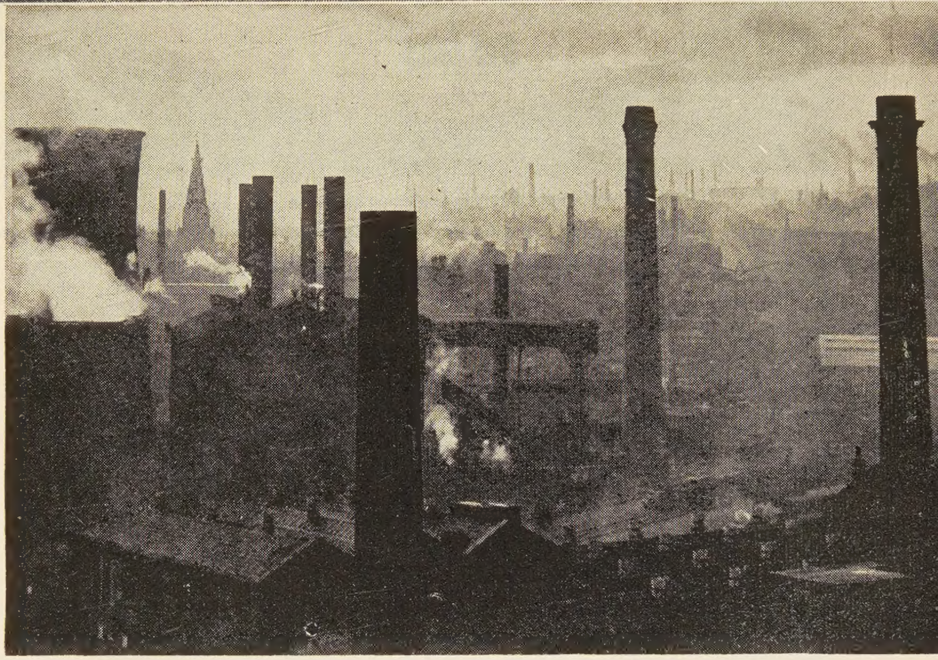
(a) The specialist, large-scale trader with overseas connections has an intimate knowledge of market requirements in many parts of the world.

(b) Knowledge of market requirements reduces the risks inherent in the meat trade, for which animals have to be bought perhaps months before the carcasses and their by-products are finally sold.

(c) Buying for disposal later requires considerable financial resources and the large-scale operator can command the necessary capital.

Producers sell their fat stock to meat operators or traders who provide a buying organisation and have the stock processed at their own or at independent freezing works. At the beginning of each season the meat operators announce the prices they are prepared to pay producers for various classes of meat. These prices are known as the fatstock schedule prices.

▲ The opening up of the virgin lands of New Zealand, which were eminently suited to livestock production, coincided with the rapid development of a wide range of industries and a marked increase in the → urban population of the United Kingdom.



[United Kingdom Information Office

Fatstock Schedule Prices

A fatstock schedule price is a composite one designed to pay for the dressed carcass and principal by-products at a price based on the dressed weight of the carcass. At the same time, the price includes adjustments to provide for adequate returns to the meat operator for his marketing services and to the freezing company for killing, freezing, and so on. The schedule prices may be altered from time to time throughout the season as circumstances warrant.

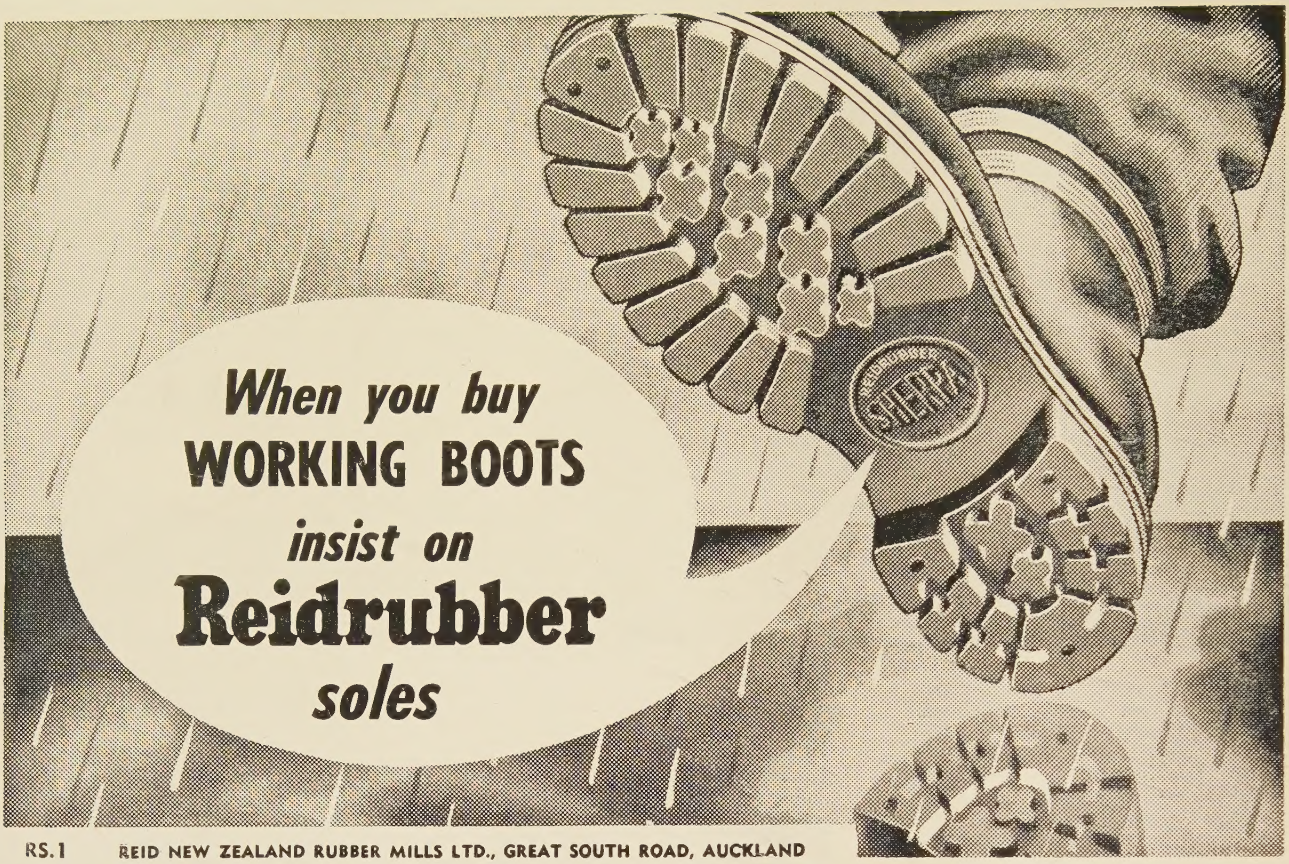
If producers wish, they may elect not to sell their meat at the schedule prices and may avail themselves of what is known as the "open door" policy, that is, the statutory right to have stock killed on own account at any freezing works in the country. By electing to have stock dealt with in this manner the producer takes upon himself some of the financial risks which are normally borne by the meat operator. For instance, a producer selling stock at schedule receives payment on date of killing, but stock sold on own account will be paid for as the proceeds of the bare meat and various by-products come to hand. This may not be for weeks or months after stock slaughter, depending on when sale is effected. Whether or not the producer benefits from undertaking this risk is dependent on the state of the market during the period; if prices rise, he stands to gain, but the converse is the case if prices fall.

A floor price scheme for meat has been in operation since October 1955. At the beginning of the season an announcement is made of the floor price for each class of export meat. These prices remain unaltered throughout the season and a deficiency payment is announced when the following week's schedule price for any class of meat falls below the floor price. Meat exporters add this amount to the price paid to producers and are reimbursed from the meat industry reserve funds.

In fixing the floor prices the price fixing committee must take into account average market prices of export meat over the previous three years, and it may also take into account future market prospects, the level of prices for other farm products, and the general level of costs and prices, including wages, in New Zealand.

United Kingdom Market

Table 2 shows the importance of the United Kingdom as a market for New Zealand meat, and reference has already been made to some of the factors which have influenced the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growth of this trade. With the onset of the depression in the 1930s, the mutual benefits to be derived from the trade were formally recognised and given expression in what is commonly known as the Ottawa Agreement of 1932. Under this agreement New Zealand extended preferential tariff treatment to United Kingdom goods and in return received certain concessions for her exports in the United Kingdom market. In respect of meat the agreement provided for the duty-free entry of the New Zealand product and for no limitation on the quantity of our meat that might be placed on the United Kingdom market during the period ended 30 June 1934. On the other hand, rigid quotas were placed on the importation of foreign meat into the United Kingdom. The two countries agreed to adopt a policy that would have for its objective the two-fold purpose of raising the price of meat to a remunerative level and of progressively increasing the share of the Dominions in the United Kingdom market.

In 1939 the first bulk purchase agreement for the sale of meat was concluded between the United Kingdom and New Zealand. Similar agreements were made in subsequent years and the marketing of meat did not return to the hands of individual traders until 1954.

The factors mentioned, coupled with the need to maintain maximum supplies of foodstuffs to the United Kingdom during the Second World War and the post-war years, account for the predominant place occupied by the United Kingdom as a market for our meat.

The sharp decline in New Zealand meat prices on the United Kingdom market in 1956 was one of the principal reasons for the New Zealand trade mission to the United Kingdom in April 1957. All the portents were that the market there was reaching the limit of its capacity to absorb, at prices remunerative to New Zealand, increasing supplies of meat produced in this country.

Production of meat in the United Kingdom during the last decade has expanded rapidly. In 1950 it amounted to 604,000 tons of beef, 331,000 tons of pig meat, and 149,000 tons of mutton and lamb. In 1958 the corresponding figures were 798,000 tons, 644,000 tons, and 190,000 tons, increases of 32, 95, and 28 per cent respectively. More detailed statistics of meat production in the United Kingdom in recent years are given in Table 3.

TABLE 3—MEAT PRODUCTION IN THE UNITED KINGDOM
(000 tons)

	1955	1956	1957	1958
Beef and veal	703.9	806.1	821.8	814.0
Mutton and lamb	174.4	193.8	199.1	190.1
Pork	368.2	362.0	379.2	428.1
Offal	124.0	134.3	137.0	137.0
Bacon and ham	242.4	208.7	211.7	215.9
	1,612.9	1,704.9	1,748.8	1,785.1

In addition to the substantial increase in domestic production, imports of meat into the United Kingdom have, generally, continued to rise, a rise which has been possible because of the marked increase in per capita consumption by the British population. Table 4 shows that per capita consumption is now well above what it was before the war and this poses the question whether any further increase in consumption per head can be expected, or whether New Zealand faces the prospect of reduced sales of meat in the United Kingdom.

TABLE 4—ESTIMATED PER CAPITA CONSUMPTION OF MEAT IN THE UNITED KINGDOM (lb)

	Average 1934-38	1954	1955	1956	1957	1958
Beef and veal	54.9	44.3	46.6	53.6	54.2	51.5
Mutton and lamb	25.2	21.7	24.5	23.4	22.4	23.0
Pork	10.6	17.9	17.9	16.5	17.3	19.0
Offal	7.4	7.8	8.0	8.4	9.1	9.0
Total ..	98.1	91.7	97.0	101.9	103.0	102.5
Bacon and ham	28.1	25.0	25.8	24.3	24.7	25.0
Canned meat ..	3.1	7.6	8.5	7.9	9.1	n.a.
Poultry ..	5.1	5.4	6.4	7.3	7.8	n.a.
Grand total ..	134.4	129.7	137.7	141.4	144.6	n.a.

n.a., not available

For New Zealand a disturbing feature of Table 4 is the tendency for the consumption of mutton and lamb to decline despite the increase in consumption generally, particularly of poultry and canned meat. The increasing consumption of canned meat is also very significant in itself. In 1957 imports amounted to 201,952 tons, which is the equivalent of about 400,000 tons of carcass meat, and represents a consumption level per head of about 18 lb carcass weight equivalent. The popularity of canned meat is no doubt due to the need for working housewives to have easily prepared foodstuffs and is a reflection of the advance in living standards with the emphasis on a greater degree of leisure.

As the population of the United Kingdom is increasing slowly, it would seem that the capacity of the country to consume greater quantities of meat is slowing down. At the same time it is quite evident that the United Kingdom Government does not propose to discourage domestic production. In fact, declared policy is quite to the contrary. Meat production is heavily subsidised and the Government White Paper issued after the Annual Review and Determination of Agricultural Guarantees in March 1958 said, among other things:

> "While there should be a reduction in the resources devoted to producing commodities in abundant supply . . . there is room for further diversion of resources to the production of beef and lamb and of feed crops."

To further this objective, an increase of 1s. per live hundredweight was made in the guaranteed price for fat cattle. That this was the only guaranteed price increase for 1958-59 gives it added significance.

Another factor which has an important influence on the United Kingdom meat market is the extent of shipments from Argentina. In 1956 the United Kingdom's imports of beef and veal from Argentina were over 90,000 tons greater than in 1955. A further increase took place in 1957, when imports rose to 257,000 tons compared with 248,000 tons in the previous year, and shipments in 1958 amounted to 256,000 tons.

Some decline in future supplies from this source now seems possible, as, from all accounts, livestock slaughterings in Argentina have been excessive, and the possibility of an early recovery in stock numbers has been made remote because a high proportion of female breeding stock has been killed.

Nevertheless, by far the greater proportion of Argentina's production of meat is absorbed by the local market and during the past two years consumption per person has attained record levels. Out of a production of 2,141,000 tons of beef in 1957, the home market accounted for 1,723,000 tons.

The level of exports in the future could therefore be maintained by restricting consumption, by increasing export incentives, or by a combination of both these devices. In fact, it has been recently reported that the Government of Argentina has decreed that meat consumption must be cut by 30 per cent from the level of July 1958. The issue of an order forbidding restaurants, hotels, and similar establishments to serve meat on Mondays and Fridays is among the measures taken to make this edict effective.

Though the prices being received in the United Kingdom at present (March 1959) for New Zealand meat, particularly beef, are not such as would suggest that the market is becoming saturated, this situation is partly due to the strong demand in other parts of the world and the diversion of supplies to these areas.

Other Markets

Though the United Kingdom is traditionally New Zealand's principal export market for meat and must remain so for the foreseeable future, there has been for some years a growing realisation of the need for supplementary markets. Efforts made during the past few years to develop alternative markets have had a good deal of success. Of exports from the 1954-55 season's production, about 14 per cent went to markets outside the United Kingdom. The relevant percentages in subsequent seasons were:

Season	To markets other than United Kingdom
	(per cent)
1955-56	18.2
1956-57	19.4
1957-58	28.9

North America

At present there is a very strong demand for our meat in the United States, and at 3 January last 82,500 tons of the 1957-58 season's production had been shipped to that country. Though it is to be hoped that the demand from the United States, which, incidentally, is primarily a demand for beef, will continue at a high level, it must be remembered that total production of red meats in the United States in 1958 was the lowest since 1954. This was due to:

(a) The reduction in livestock production that followed the drought and low prices of 1955-56.

(b) Producers choosing to retain more of their livestock for the expansion of herds than in any year since 1951.

The year 1958 in the United States was excellent for feed growth, and feed prices were favourable to purchasers. These factors had an influence on the number of stock slaughtered and retained on farms. Total cattle and calf slaughter in 1958 has been estimated at about 12 per cent below that of 1957, and the number of cattle and calves on farms at 1 January 1959 was probably 2 to 3 million greater than a year previously. It is probable that in 1959 cattle herds will be expanded further at the expense of killings, with the net effect of only a relatively small increase in beef production.

At the same time hog numbers are building up rapidly and pork production is likely to increase markedly during 1959. The overall effect could be to attract some consumers away from beef and to depress prices. In the longer term some decline in demand for beef from the United States must be expected as the cyclical movement in cattle numbers approaches its peak.

At present the United Kingdom buys practically all our lamb, and with New Zealand's sheep population increasing as it is the time appears to be fast approaching when we will require additional outlets for lamb. Shipments of 1957-58 season's lamb to the United States and Canada during the year ended 30 September 1958 amounted to about 2,300 and 5,400 tons respectively, and it is in these countries that the prospects of developing important supplementary markets are brightest. The United States and Canada both have relatively small sheep flocks. At the same time living standards are high, and the practice of eating mutton and lamb has already been established, though in both countries per capita consumption is low (about 4 lb annually in the United States and less than 3 lb annually in Canada; the comparable figure for New Zealand is about 76 lb and for the United Kingdom 23 lb). In fact, consumption per head today is little more than half of what it was before the Second World War.

The potentialities of the United States and Canadian markets for lamb are tremendous. Even if the population was static, an annual increase in consumption of 1 lb a head would result in a total increase in demand of about 85,000 tons. Those concerned with the marketing of New Zealand meat overseas are aware of this, and we can have confidence that every endeavour is being made to develop the opportunities which undoubtedly exist.

Western Europe

In the past the main markets outside the United Kingdom for New Zealand's meat have been the countries of Western Europe. The principal European countries such as Belgium, France, Holland, Italy, and Western Germany all enjoy the fruits of industrialisation and their general standards of living are relatively high. They can, therefore, afford the more expensive livestock products such as meat.

The Western European countries all have intensively developed, protected agricultural industries and, in recent years, New Zealand's exports of meat to these areas have declined. There are grounds for fearing that the movement toward closer integration in Europe will result in the intensification of protectionist policies for agriculture. The European Economic Community, which consists of Belgium, France, Italy, Luxembourg, the Netherlands, and Western Germany, came into effect on 1 January 1958. The broad aim of the E.E.C. is the eventual complete economic and political integration of the participating countries.

The provisions of the Rome Treaty, which gave birth to the Community, do not provide for the liberalisation of trade in agricultural products to the same extent as they do for industrial goods. Rather, the indications are for a continuation of existing income and price supports for agriculture and, ultimately, a unified market in agricultural products. The agricultural provisions of the treaty are, however, written in general terms, and their effects on New Zealand's market opportunities in the six signatory countries will depend on their practical interpretation over a period of years.

In addition to the E.E.C., which is now an accomplished fact, the Western European Governments, including the United Kingdom, have been considering for the past two years the formation of a Free Trade Area (F.T.A.) which would embrace the six countries of the E.E.C. and the remaining eleven members of the Organisation for European Economic Co-operation (O.E.E.C.). Though the negotiations toward this end have, at time of writing (March 1959), virtually broken down, it seems likely that some means of associating the United Kingdom and the other members of the O.E.E.C. with the E.E.C. will be eventually found. A European F.T.A. or some such similar arrangement could have important implications for New Zealand's meat marketing prospects in the countries concerned. It is not proposed to go into this question here, but a subsequent article will deal with this matter and the broad effects on New Zealand of the E.E.C.

Asia

During the 1956-57 season Japan bought 15,500 tons of New Zealand beef. Since then the allocation of exchange for the importation of meat has been reduced and sales from the 1957-58 season's production amounted to a little more than 2,500 tons. Nevertheless, Japan is the most highly industrialised country in the East and consumption of meat could expand rapidly as standards of living are raised and taste becomes more widely developed.

Other Far Eastern areas must remain primarily potential markets until increasing economic development has had an appreciable effect on the general level of incomes.

Eastern Europe

The U.S.S.R. and a number of other countries in Eastern Europe are irregular buyers of New Zealand meat. These countries tend to favour bilateral trading and therefore look for corresponding increases in imports of their products by the countries from which they buy. New Zealand favours trade on a multilateral basis, and reciprocal deals are not always possible or desirable. New Zealand will probably continue to sell some meat to these countries, but the trade will probably remain sporadic.

West Indies

The West Indies should continue to remain a valuable supplementary market for New Zealand meat.

A Ruakura Animal Research Station demonstration of a project to increase beef production by crossing beef-breed bulls with some of the cows from the dairy herd. The Government has an important part to play in expanding existing markets and developing new ones, and a primary method is through agricultural research to improve standards of animal health and production.

FUTURE PROSPECTS FOR THE MEAT INDUSTRY

In 1958 New Zealand earned from exports overseas foreign exchange to the value of £273.8 million. Of this sum, £84.6 million was from the sale of meat and £82.1 million from the sale of the joint product, wool. New Zealand's production costs for these products are, perhaps, the lowest in the world. The use of additional productive factors in the sheep industry may, therefore, be justified on technical and economic grounds. Indeed, there can be no doubt that if New Zealand is to maintain her existing standard of living, and at the same time provide for a growing population, meat exports must increase. The technological advances of the past are sufficient justification for being optimistic that the years ahead will see a steady growth in the productivity of New Zealand's pasture lands and livestock.

But what of market opportunities? First, there seems little doubt that the United Kingdom will remain our most important customer for many years. This raises the question of whether the diversion of supplies from the United Kingdom to other markets, when prices in the latter markets are more remunerative, is a wise one. Some diversion of beef from the United Kingdom to the United States took place during the 1957-58 season. The sale of meat overseas is in the hands of private traders and it is for them to weigh up the relative advantages of the longer-term, assured market at reasonable prices and the benefits that accrue from spot sales in other, more or less sporadic markets at higher prices.

However, it is essential for New Zealand to cultivate markets in other areas in view of the limited capacity of the United Kingdom to absorb our expanding meat production. The efforts made so far in this direction have been rewarding and there are grounds for faith that they will be no less so in the future.

Mention was made earlier of the manner in which meat is marketed overseas and a number of advantages of the present system of sale by private operators were listed. There are always two sides to any issue and the overseas marketing of meat is no exception. Ever since the depression of the 1930s the quantitative control of imports in particular circumstances has been an important feature of the international trade policies of the nations of the world. Though the General Agreement on Tariffs and Trade (GATT) has made some progress in fostering multilateral trade, particularly in industrial products, bilateral negotiations are still very important. The U.S.S.R. and countries within her sphere of influence particularly favour the bilateral deal, and this tendency seems to be becoming more pronounced in other parts of the world for agricultural commodities.

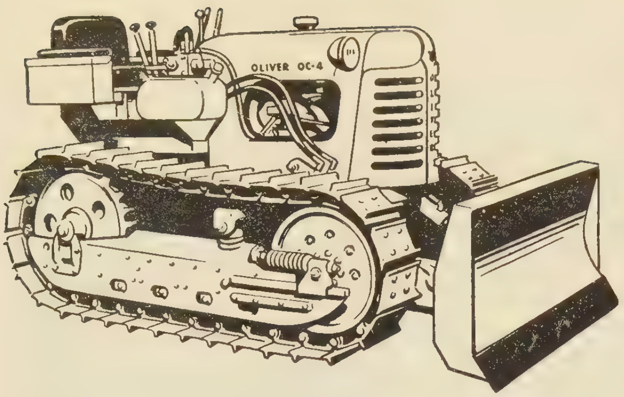
This fact raises the question of whether or not it might be in New Zealand's interests if the Meat Producers Board were to exercise in some degree its statutory right to assume absolute control of the export of meat. The ability to undertake to deliver a certain quantity of meat in the event of a quota being fixed for New Zealand would certainly be of value to the Government in the negotiation of trade agreements with other countries. Furthermore, the Board, as representative of the whole industry and with the financial backing of the industry's substantial reserve funds, might consider it worth while, as part of a plan for market development, to accept in potentially important markets lower prices than were offering elsewhere in world trade. The Board would certainly be in a better position than individual traders for this type of activity, which could well be a very profitable investment in the long run.

Government's Part

The Government has an important part to play if existing markets are to be expanded and new ones developed. First of all, the basic work of promoting agricultural research for improving standards of animal health and nutrition, raising the levels of pasture production, and inculcating in farmers the need for improved management techniques must be continued. Progress in these fields is paramount if efficiency in production and quality of product are to be improved and if New Zealand is to remain fully competitive in world markets.

Much valuable work is being done by our Trade Commissioners in various parts of the world, and further benefits should accrue from the opening up of new posts such as in the West Indies and in San Francisco.

The recently signed Heads of Agreement, which provide the basis for a new trade agreement between the United Kingdom and New Zealand, and which replace the original Ottawa Agreement, permit New Zealand to reduce existing preferential margins of duty accorded United Kingdom goods. This should assist New Zealand in negotiating for market opportunities in other countries. Further, the trade agreement made last year between New Zealand and Japan should contribute materially toward ensuring that this country obtains a substantial share of the Japanese market as it expands.



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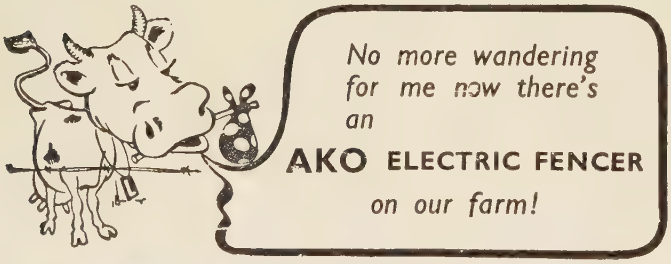

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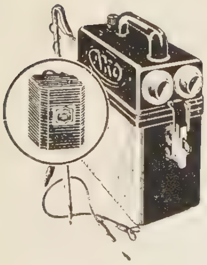

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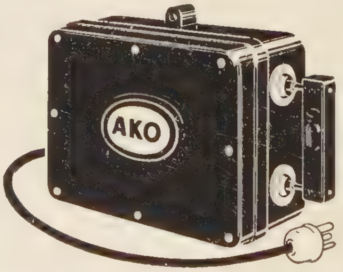

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Quality

Of primary importance in the sale of goods in any market is the maintenance of the highest possible quality. The need for quality products is even more important when an industry sells the greater part of its production in countries which have access to supplies from other parts of the world. If quality standards are to be improved, there must be unceasing effort to improve chilling and freezing techniques, which are so important because of New Zealand's distance from world markets.

Standards of hygiene have always been very important, but the development of the boneless beef and veal trade with the United States soon showed that processing methods which had proved acceptable over the years required to be adjusted. The practice followed by meat plants in the United States of placing boneless meat directly from cartons into the mincers without prior thawing of the meat necessitated a thorough examination of meat handling by both the management of meat export works and the meat inspection staff of the Department of Agriculture. All meat being packed is now subject to additional check inspection.

It is hoped that the industry will cooperate fully with the Government in maintaining existing standards and effecting any necessary improvements.

The question of quality of meat extends to such matters as to the most desirable type of carcass, and in this respect each market must be considered separately, because preferences are not the same in all countries.

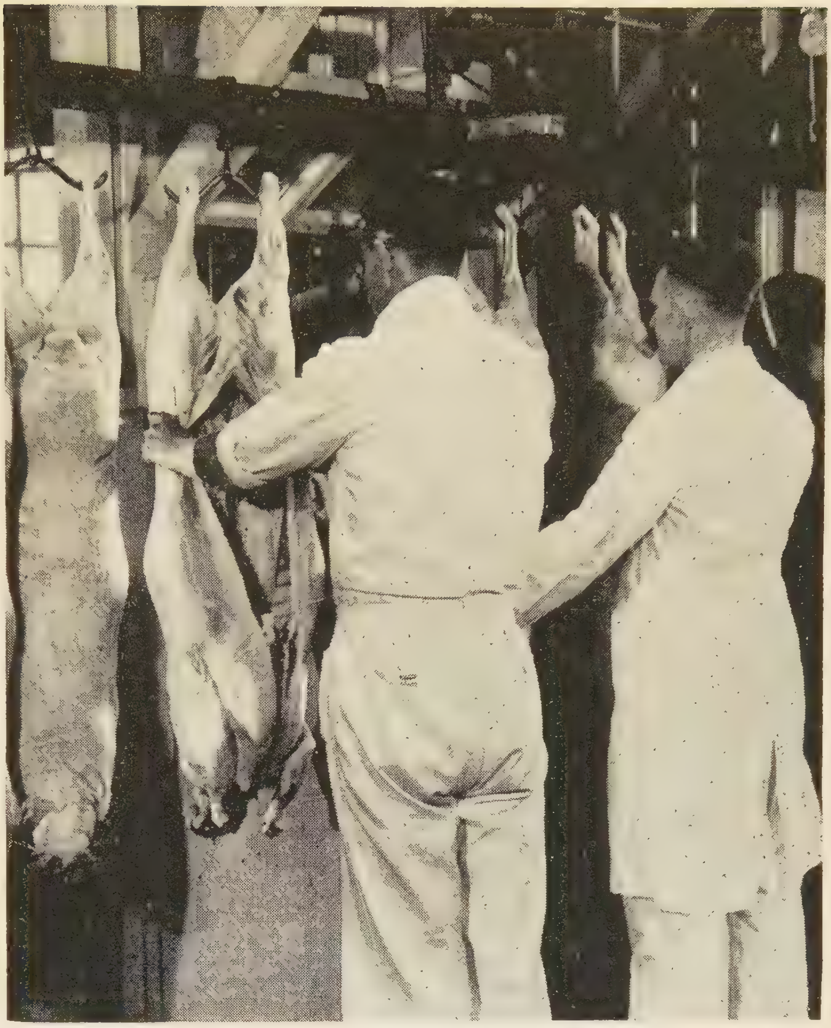
Meat Research Institute

The Meat Research Institute was established in 1955 to promote and undertake research into meat and the meat industry and to keep members fully informed on the results of such research.

The Institute plans a comprehensive programme of research and education, embracing both scientific and technological aspects of production, and at the same time maintains liaison with local and overseas research organisations. The work of the Institute merits the fullest encouragement in the interests of improved efficiency and higher standards of quality within the meat industry.

Effect of Population Growth

World population is increasing rapidly and the more advanced countries of the world are cooperating in the economic development of their less fortunate neighbours. These facts, together with the natural advantages New Zealand possesses in production, suggest that the long-term market outlook for our meat should be assured.



[*National Publicity*

Inspection of meat by Government inspectors is important for maintenance of the highest possible quality in an industry which sells most of its production in countries which have access to supplies from other sources.

At the same time it must be remembered that a large proportion of the world's increasing population is to be found in the less developed countries, where all but a very small proportion of the people have incomes so low that anything more than token meat consumption is unthinkable within the foreseeable future. The needs of these people are so very great and so very urgent that inevitably their Governments have adopted welfare state policies, which means high and progressive taxation on that proportion of the population, small as a percentage but representing considerable numbers for all that, who might otherwise expand their consumption of meat. Again, because of their rapid development, most of these countries are in chronic balance of payments difficulty, which means that import controls restrict all but the most necessary goods.

This suggests that while the world "population explosion" will certainly create a demand for food, a good deal of that demand may be ineffective as far as semi-luxury goods such as meat are concerned. It suggests, too, that New Zealand should concentrate its market expansion efforts in those countries where food policies and income levels are such that increased consumption of the types of products we have for sale is a practical possibility. In practice, this means directing our efforts mainly at North America and Western Europe.

◆

The upper photograph on page 522 is by Sparrow and the lower one by National Publicity.

Cattle Disease Outbreaks in North Island

Widespread Quarantine and "Standstill" Controls

SUDDEN deaths of young dairy cattle on a farm near Carterton in the Wairarapa about mid February were reported for veterinary attention, and subsequent investigation led to almost positive diagnosis of the cause as mucosal disease, not previously reported in New Zealand. A slaughter and compensation policy was adopted with the first and two subsequent outbreaks and in March and April widespread controls were placed on the movement of people and stock in the Wairarapa.

RIGOROUS control and disinfection measures and meticulous checking and observation of possible contacts with infected properties appeared for some time to be confining outbreaks within the Wairarapa, but early in May an outbreak was confirmed near Waipukurau in Hawke's Bay. At time of going to press six outbreaks had been confirmed.

First Outbreak

Within a few days of trouble being reported on the Carterton farm 36 heifers had died. The farm as quarantined after investigation by officers of the Department of Agriculture and the dead stock were buried.

The affected stock had come to this property for summer grazing from about a dozen different farms, each of which was investigated by the Department in an effort to trace the origin and cause of the trouble.

By the beginning of March about 50 yearling replacement heifers had died. Field and laboratory studies continued and during March the infection was diagnosed as mucosal disease, which was first recorded in the United States in 1951.

Symptoms

The following observations were made by officers investigating outbreaks: One or more animals were seen to be off their feed, standing stiffly by themselves, and sometimes dribbling from the mouth. The temperature was high in the early stages, dropping rapidly afterward. Affected animals lost condition rapidly, and a dark-stained scour developed, though death might occur before this was evident. They did not eat, but they drank.

Deaths in the early stages were rapid, from one to three days after the onset of symptoms. Ulceration of the throat and digestive system and marked changes in the kidneys were evident on post-mortem.

After the cause of the outbreak on the Carterton farm had been diagnosed as mucosal disease, all cattle on the farm were killed and buried. An adjoining farm with which there was exchange of stock in normal farm management was later also quarantined.

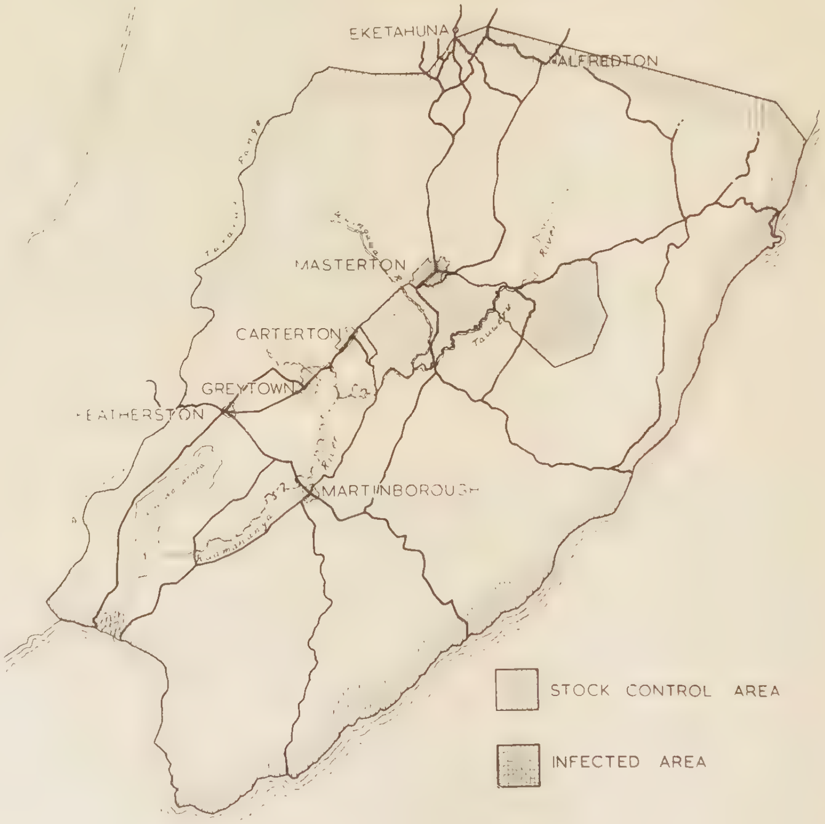
All stock within a two-mile radius of the farm was inspected for signs of the disease.

Second Outbreak

On 9 April the Wairarapa Farm of Instruction, about two miles from the first infected farm, was quarantined as an "infected place" after the deaths on 6 and 8 April of young steers there. (No entry is allowed to a quarantined or "infected" place and there is an absolute "standstill" order on stock on it.)

An "infected area" of about three miles radius from the training farm was declared to assist in control and investigation of the disease. No movement of stock was allowed within this area without permission of the Department of Agriculture. About 240 cattle and 90 pigs on the infected farm were destroyed.

There were about 78 farms in the "infected area", and 34 "contact" farms outside the area, most of them in the lower part of the North Island but some further afield, were quarantined, and all stock on them inspected. (A "contact" farm is one to which people have returned or stock have been moved from a property on which outbreaks have subsequently occurred; quarantine remains in force until it is considered the incubation period of disease has expired.)



"Infected areas" and "standstill areas" declared in the Wairarapa are shown on the map. An "infected area" was also declared east of Waipukurau, but in subsequent outbreaks only the property on which the disease occurred was declared an "infected place" and quarantined.

INFECTED AREA
STOCK ACT 1908.
NO ADMITTANCE
EXCEPT ON
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DEPARTMENT of AGRICULTURE

▲ Control of the movement of stock and people to prevent spread of the disease entailed the posting of notices and the staffing of traffic control points in several districts.

▼ Entry to the "standstill area" in the Wairarapa was through control points staffed by the Police Department. Disinfectant impregnated mats were used on some roads traversing "infected areas".

Third Outbreak

A week after the disease appeared on the Wairarapa Farm of Instruction a third infected property was found at Te Ore Ore within the previously declared "infected area". The three cattle on this farm were destroyed and the property was quarantined.

Working on the basis that the best means of controlling the spread of the disease was to prevent the movement of stock outside a fairly large area, the Department issued a "standstill" order covering the Wairarapa from Eketahuna south to Palliser Bay, an area roughly 60 miles by 40 miles.

The restrictions imposed under the standstill order were:

No animals allowed to move in or out of the "standstill area", except livestock carried by rail from points north of the area, provided there was no unloading within the area and no prolonged stopping at stations.

No farm produce such as hay, seeds, and grain could be taken outside the "standstill area"; transport of market garden produce was allowed under permit. Hides and sheepskins could not be taken out. A permit was needed to shift wool.

Farm-to-farm visiting was discouraged and official visits such as for herd testing were cancelled.

Hunts, dog trials, stock sales, and similar gatherings were cancelled.

Aerial topdressing was halted.

Check points staffed by the Police Department were set up at points of entry to the "standstill area".

Fourth Outbreak

A case of the disease in one of seven house cows on a farm about 13 miles south-east of Masterton was diagnosed on 26 April. The property, which was outside the previously declared "infected area", was immediately isolated and the boundaries of the "infected area" were extended to include it and adjacent country.

As the small house cow herd could be completely isolated from remaining stock on the property, it was decided to establish an on-the-spot field study of the remaining six animals in an attempt to learn more about the disease. Stock management on the property was supervised by officers of the control organisation and stringent precautions taken to isolate the in-contact animals and the property.

Fifth Outbreak

Incidence of the disease among young beef cattle on a property about 1½ miles east of Waipukurau in Hawke's Bay was confirmed early in May and an "infected area" declared embracing this and a number of neighbouring properties. As in the fourth outbreak, slaughter policy was not implemented but a field study of the outbreak was established under strict quarantine. The same restrictions that applied to movement of stock in "infected areas" in Wairarapa applied in the Waipukurau outbreak.

Several properties outside the "infected area" to which contacts with the confirmed outbreak were traced were quarantined as "infected places".

Mucosal Disease

Early in May R. M. Salisbury, Chief Diagnostic Officer at Wallaceville, and Dr L. B. Fastier, a specialist in virus diseases, visited the United States to get at first hand up-to-date information on diagnosis and control of mucosal disease and to discuss it with workers there.

Mucosal disease as it has occurred in other countries affects cattle only. Only cattle, both beef and dairy types, were affected in the cases reported above, and most of them were young stock up to two years old.

Problems in Production and Use of Our Wool Must be Solved in N.Z.

BECAUSE New Zealand is the only country with an advanced agriculture producing large quantities of wool stronger than 52s count, the problems arising with the production and use of this type of wool will not be solved by overseas research but only by our own efforts in New Zealand, according to D. A. Ross, New Zealand Wool Industries Research Institute, Dunedin. The need for an immediate and vigorous wool-improvement programme was shown by the fact that only 10 per cent of New Zealand wool is free from serious faults and that 30 per cent is very faulty and inferior. Some basic problems of wool research which, though they affected every wool producer, were largely ones to which growers had probably given little thought were discussed in a paper by Dr Ross, an adaptation of which follows, to the second Invermay Farmers' Conference at Mosgiel in March.

ANSWERS to the three following questions are needed to form a sound basis for a wool-improvement programme in New Zealand:

1. What types of wool do we grow?
2. What types of wool do we want to grow?
3. How do we change from what we have to what we want?

1. What Types of Wool Do We Grow?

We must know the characteristics of the various types of wool we grow before we can plan any comprehensive programme for wool improvement. Unfortunately only a small part of this information is available. Improve-

"Serious attention must be given → to the characteristics of the types of wool we wish to produce by finding out the importance of these characteristics during the manufacturing process and in the final cloth".

[*Sparrow (upper) and National Publicity (lower) photos* ment of any wool clip is based on measurement, both subjective measurements such as eye estimates of style, count, yield, and colour, and objective measurements such as the accurate determination of fibre and staple length, crimp, fibre density, yield, and other physical and chemical characteristics of a fleece.

The following example will illustrate the problems which arise because of our lack of knowledge of the physical characteristics of New Zealand wools. The Wool Industries Research Institute was interested in the carrying out of a trial to assess the relative importance of crimp on the manufacturing performance of wools of similar staple length and mean fibre diameter. As some 70 per cent of our wool production is coarser than 52s count, it was suggested that this trial be carried out on 48s count wool. As a basis for selecting the wools it was necessary to know what was the normal number of crimps per inch, staple length, and mean and range of fibre diameters for wool of 48s count. Such information was, however, not available, so that before any wools could be selected for a mill trial the Institute had to carry out a survey of the characteristics of what the wool classers of New Zealand thought was 48s count Romney crossbred wool. Such a survey is only a start in obtaining basic data about New Zealand wools on which an improvement programme may be soundly based.

The results of this survey illustrated the wide divergence of opinion among wool classers on what is a 48s count wool. Ten wool classers separately graded the 67 samples sent in as 48s count wool. Their average gradings for the individual samples ranged from one sample of 44/46s to five samples of 50s. This lack of standardisation of the meaning of wool terms applies much more widely than to just count or quality numbers. Agreement to use, and on the meaning of, one set of wool terms throughout the wool trade would be a very important forward step.

Faults

At least half of the fleeces grown in New Zealand each year are tender or have a break. Associated with this break are the other wool faults of cotting, yolk stain, caky yolk, pink rot, and dingy wool. Some of these secondary faults, such as cotting and caky yolk, may result directly from the formation of the break. Eliminating the break will therefore eliminate these other wool faults. Before any concrete programme of research on break can be initiated an objective method of accurately measuring the degree of break must be found. After considerable research the Institute has devised a method for measuring break and further work on this fault can be carried out.

This illustrates another of our problems. Basic methods of measuring many of our wool faults and many fibre characteristics have not been devised and until they have been no progress on these problems can be made. New Zealand research workers are in an unfortunate position in this regard, for almost all overseas wool research is carried out on fine wools of counts 56s and finer, and techniques of wool measurement which are satisfactory with fine wools are often not immediately applicable to New Zealand crossbred types.

Some Data Available

However, New Zealand is fortunate in having data on count, style, yield, and price of every lot of wool sold at auction. The New Zealand Wool Commission appraisers grade each lot of wool and a general picture of our wool production can be obtained from the data published by the Commission at the end of each wool-selling season.

There has, however, been very little effort made to interpret the information put out by the Commission to the farmer. Secondly, only a minute fraction of all the data which are collected is analysed and published, and thus only a very general picture of our clip is released. Detailed analysis of this information would be very helpful to give a more complete picture of our wool production.

Many Problems

That New Zealand has many wool problems is apparent from just a glance at the Commission's statistics of the style grading of fleece wool. The following table shows the percentage of wool for the past five seasons in the three style grading groups:

A and BB: Good wool, free from serious faults.

B: Average wool; usually has at least one serious fault.

C and D: Inferior wool; usually has many serious faults.

STYLE GRADINGS AND PRICES OF GREASY FLEECE WOOL SOLD AT NEW ZEALAND AUCTIONS FROM 1953-4 TO 1957-8

	Style grading		
	A and BB	B	C and D
	per cent	per cent	per cent
1953-4 ..	10.4	60.9	28.7
1954-5 ..	11.7	61.5	26.8
1955-6 ..	8.8	57.5	33.7
1956-7 ..	10.1	57.3	32.6
1957-8 ..	7.4	65.0	27.6
Average ..	9.7	60.4	29.9
	Price per pound		
	d.	d.	d.
1953-4 ..	62.9	54.6	51.0
1954-5 ..	57.7	53.8	50.7
1955-6 ..	55.6	50.6	47.0
1956-7 ..	64.0	60.5	57.3
1957-8 ..	55.9	47.1	40.4
Average ..	59.2	53.3	49.3

It is rather alarming to find that only 10 per cent of our fleece wool is graded as being relatively free of faults, while 60 per cent is mediocre and contains one or more serious wool faults. Thirty per cent is just plain inferior and full of cotts, tender wool, seed, colour, and bush stain. A few wools will also be down graded for poor skirting, which puts them in a lower style group.

The table also shows that A and BB grade wool was worth 6d. a pound more than B wool, and B wool was worth 4d. a pound more than C and D wools. Dr A. E. Henderson in the Lincoln College Technical Publication No. 12, "Faults in New Zealand Wool", states: "Considering the whole situation it is apparent that the incidence of hereditary faults is fairly low, while on the other hand, faults associated in some way with management are most common. The evidence presented suggests also that correction of these faults would probably not be difficult and would be an economic proceeding."

One frequently hears that New Zealand produces good crossbred wool. This may be so when our wool is compared with wool of similar count grown overseas. While this is a self-satisfying comparison, it hides the fact that 90 per cent of our wool is faulty and 30 per cent of it is just horrible.

2. What Types of Wool Do We Want to Grow?

When a relatively clear picture of the characteristics of the types of wool which we are producing has been obtained, we must decide what types of wool we want to grow. The general aim of the wool producer is to obtain the maximum economic return per acre from his clip, within such limits as are set by the fertility, topography, climate, and methods of management of his farm.

The answer to this question presupposes that detailed knowledge is available of the relationship between the characteristics of the fleece and that of the final fabric. This is not so. The manufacturer knows the general wool characteristics which are necessary to make a given type of cloth, but not the effect during manufacture of the finer fleece detail. What is the importance during manufacture and in the final cloth of fineness, crimp, fibre, and staple length, colour, handle, and wool faults such as break, cotts, seed, and stains? How large a premium or discount should be paid for these characteristics?

A start has been made on this problem at the Textile Research Institute, Princeton, U.S.A., under the auspices of the International Wool

Secretariat. In one experiment two Australian wools were selected which were of similar staple length and mean fibre diameter but which differed in the number of crimps per inch, one wool having a high crimp level of 15 crimps per inch and the other wool a low crimp level for this diameter of 9 crimps per inch. The performance of these two wools was closely studied at all stages of processing through to the final cloth.

It is a little early to draw definite conclusions from experiments of this type, but they do indicate that with wools of constant diameter the wool with the larger number of crimps per inch is slightly superior in ease of carding, spinning limit, fabric thickness and handle, resistance to damage in dyeing, flex-abrasion resistance, extensibility, and crease resistance. Similar trials on other aspects of this work are being carried out and much useful data on the manufacturing importance of wool characteristics as well as the development of useful techniques of fibre measurement are being obtained.

There are numerous other aspects of this problem of the types of wool we should grow. The vagaries of the wool market both within and between wool seasons increase the difficulties of assessing accurately the true commercial value of the various types of wool. Changes in the pattern of demand alter the relative prices of different types. Our aims must, therefore, be sufficiently elastic to allow for changes in production when genuine changes in market demand occur.

What are the ultimate uses of our wools? Will one particular lot of crossbred be used in the combing, woollen, or carpet trade? Will it be used as it is, partly sorted, or will it be divided into four or five different types of matchings? Will it be used without blending or will it be mixed with other types of wool from New Zealand or other countries? If it is blended, how do we determine its importance in the final cloth?

3. How Do We Change from What We Have to What We Want?

It is apparent from the preceding sections that at the moment this question is to some extent academic because of our lack of detailed knowledge of the characteristics, economics, and uses of the types of wool we are growing. However, there is an obvious necessity, and one to which immediate attention should be given, to improve the style grading of our clip. The clip is down graded for faults, the severity of which may be reduced or avoided by altering management. This will result in wool freer of faults and at the same time lead to increased fleece weight.

Research must proceed also on the inheritance of wool characteristics so that practical breeding programmes for wool improvement can be worked out. We need to know more about the relation of food intake (both in quantity and quality) and wool production and about the methods and economics of supplementary feeding to avoid break and its associated faults.

Hairiness in Stud Ram

A stud breeder bought a ram at a New Zealand sale for about 1,000 guineas. This ram was possibly a good buy for a breeder interested in producing carpet wools, for it was found to have a very hairy fleece with 48 per cent of heavily medullated fibres. The stud which sold the ram and also the one which bought it cannot be paying very much attention to the quality of the wool of their sheep. Hairiness is quite highly inherited and the offspring of this ram will also have hairy fleeces. It is possible to produce a strong wool that is free or virtually free from medullated fibres.

This example illustrates another very serious problem which affects wool research in New Zealand. This is the attitude common in this country that wool production is a by-product of sheep raising. This has led to a rather fatalistic outlook and an attitude of "Is it worth worrying about?" This is no doubt partly due to the wide fluctuations in wool prices, which are largely beyond the control of the producer. The acceptance of a price with the hope that it will be better next season for the same style of wool does not encourage wool improvement.

This lack of interest is also reflected in the farming and scientific Press throughout New Zealand. Very few articles are published on wool, preparation of the clip, faults and their elimination, economics of production, and general set-up of the industry. This again is due to the very small number of people both in extension services and in research whose primary concern is wool research and improvement.

How many farmers keep a close eye on the shearing of their sheep and the classing of their clip? They will compare the price received this year with last year's, but how often do they consider whether the quality of the wool was better and if it was freer from faults than the previous clip? If it was not as good as the previous year's, what about improving it? Did they compare it with other wools in the store, and see if it was well presented for sale?

Conclusions

- Our research must be put on a firm footing by first obtaining a clear picture of the types and uses of the wools we produce. Agreement to use, and on the meaning of, one set of wool terms throughout the wool trade would be an important forward step.

- Serious attention must then be given to the characteristics of the types of wool we wish to produce by finding out the importance of these characteristics during the manufacturing process and in the final cloth.

- Because overseas research is confined largely to wool of 56s count and finer, problems of production and use of New Zealand Crossbred wool of 46 to 50s count will not be solved overseas, but only by our own efforts.

- That there is an immediate need for a wool improvement programme is shown by the fact that only 10 per cent of our wool is free from serious faults, while 30 per cent is very faulty and inferior. More use must be made of the data that are available on the economics of wool production and marketing.

- Probably the most pressing problem is to secure recognition of the vital part wool plays in our economy and to change the attitude that wool is a by-product of sheep farming and the attendant fatalistic outlook on wool improvement.

Book Review

"Farm Work Study": N. Harvey

THE purpose of this book is to describe some elementary techniques of work study and show their application to farming activities. Standard procedures are set down for examining problems. The use of charts to record how jobs are done is explained. Following this, principles for critical examination of the charts are outlined.

A number of well documented examples are worked through. These include milking routine, poultry house cleaning, silage making and feeding, and preparing seed trays.

Of its type the book is probably the best basic guide available at present. It is recommended for research workers new to the field and farmers interested in turning haphazard ways of doing jobs into orderly routines.

—*W.O.McC.*

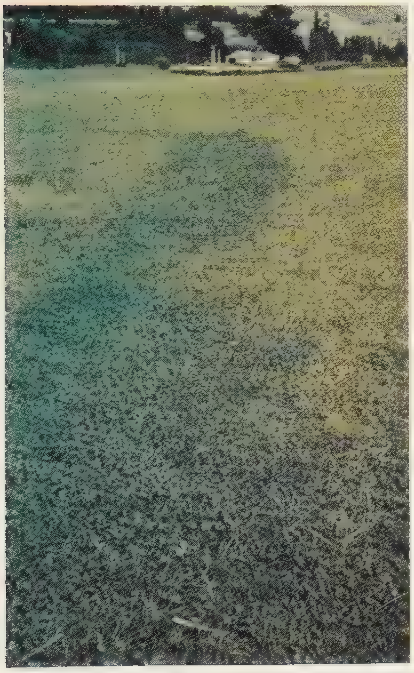
Farmer and Stock-Breeder Publications Ltd., London. 8s. 6d. net (postage 8d.).

Responses to Boron in Nelson District

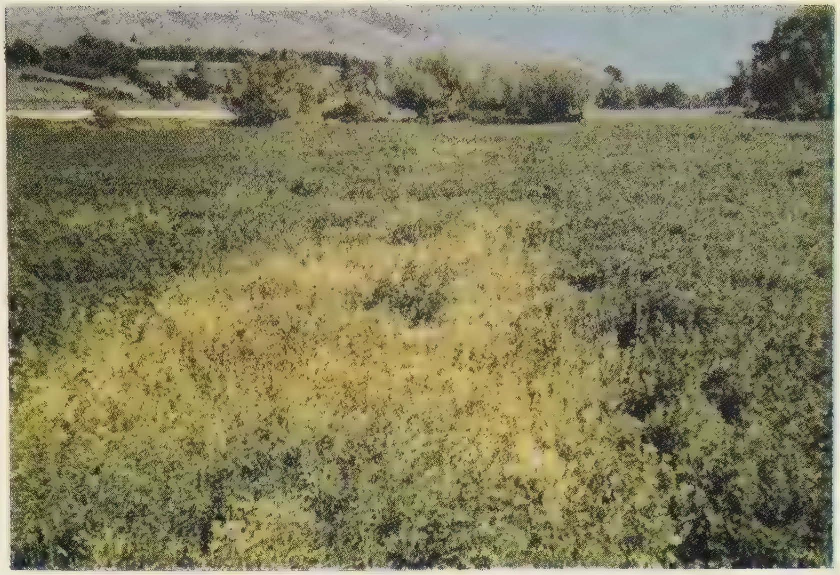
A NUMBER of trace elements have come into prominence in pasture production in recent years. Some have found a useful place in our economy; others are still under investigation. Boron has for some time been considered an important element in the growing of a number of crops, notably turnips, swedes, and mangels. Though the element has been included in a large number of experiments, it is perhaps surprising to find so little evidence of boron deficiency in pastures or even in lucerne, a crop known to be severely limited by lack of boron.

THOUGH the symptoms of boron deficiency may not be apparent to the layman, they are readily recognised by those familiar with them. The light colour with reddish discolouration of lucerne and clover leaves or sometimes yellowing at the tips are typical of the deficiency, but here a note of warning must be sounded.

It is not this discolouration in the odd plant that is important, but the general effect over the whole field. If an area is green and healthy, there is little to fear. It is in those areas where, despite intelligent applications of the major elements, the plants are still unthrifty that deficiencies can be suspected.



This significant boron response on pasture occurred where Mr M. H. Holland, of Tapawera, ran the drill across the paddock after laying down trial strips.



The outstanding response this area of lucerne gave to borax at 14 lb per acre is shown by the contrast between the treated areas at left and right and the untreated strip in the middle.

By R. INCH,
Fields Instructor,
Department of Agriculture,
Nelson

Applications of boron are not held up as a cure-all for poor farming practice, but as a possible factor of correction on those farms where good husbandry has been practised and yet results have been disappointing.

The deficiency symptoms in brassica crops are better known. Brown heart in turnips and swedes and brown curd in broccoli and cauliflower are common and widespread. Cracked stem of celery, heart rot of mangels and fodder beet, corky pit in apples, brittleness and buckling of tobacco leaves in mild cases, with stuntedness and distortion in severe cases, are symptoms familiar to those working with these crops in certain districts. The effect in all plants appears to be similar—a breakdown and blackening of the softer tissues, with death of the growing point of shoot and root in severe cases.

Factors which Influence Boron Deficiency

Availability of boron to the plant is decreased by liming, and heavy applications have commonly caused boron deficiencies in the brassica crops mentioned above. Many of the soils where the results of this deficiency occur have been quite heavily limed in the past, especially in parts of Otago and Southland, so perhaps it is all the more surprising that pasture deficiencies have not been more noticeable and widespread. Though boron is readily leached from the soil by heavy rainfall, its availability to the plant is also decreased under dry conditions. A relatively sudden onset of boron deficiency frequently occurs where a period of moist, quick growing conditions is followed by rapid drying out. Boron deficiency is common on free-draining, sandy soils, and on these can be influenced by the three factors mentioned—liming, the effects of which are rapid on sandy soils, winter leaching, and rapid drying out. On heavier soils one would not expect results to be so quickly noticeable.

Results in Motueka and Tapawera

In the past year a number of boron responses on lucerne and pasture have been noted in the Motueka and Tapawera areas. Results have been striking and should open up a new field for investigation in the Nelson district. Suggestions to farmers in the Motueka and Tapawera districts by an officer of the Dairy Board led to the application of borax on lucerne stands which were deteriorating badly and being dominated by browntop.

At the same time Departmental investigations were being made on another area at Motueka and on one at Stanley Brook. In both these the land had been well prepared and well fertilised according to modern practice before establishment. Indications from soil and plant analysis suggested a

One of the first clear-cut responses to boron applications on clover pasture in Nelson was obtained in these strips. Borax was applied at the rate of 7 lb per acre on white clover pasture in the strips at left and right in early summer. The control strip is in the middle.

probable potash deficiency, while paleness of the leaves, with reddish discolouration, showed a possible lack of boron. Potash applied to both areas gave a slight response at Motueka, but none at Stanley Brook.

On the Tapawera farm Mr M. H. Holland laid down experimental strips of (1) superphosphate at the rate of 2 cwt per acre, (2) potash, 2 cwt per acre, and (3) superphosphate, 2 cwt per acre, plus borax, 28 lb per acre. There was no apparent response from the extra superphosphate, but potash gave a little more vigour in the lucerne plants. It was the superphosphate plus borax strip, however, that was most spectacular and encouraged Mr Holland to apply borax at 14 lb with 2 cwt of superphosphate per acre to the remainder of the field in the spring of 1957. Results were outstanding and a good hay cut was taken later. A strip across the paddock where no borax was applied was very poor and showed up poorly in contrast to the remainder of the field.

After the hay had been taken off, the control strip was dressed with borax on 23 December and now can hardly be distinguished from the rest.

Having gained results such as this the farmer was encouraged to try boron applications in a ryegrass-white clover pasture nearby. Here he experimented with different rates of application, using 3, 7, and 14 lb respectively with an undressed control in between. All applications gave a clearly visible response as did another strip in the paddock where the drill was run round to empty it. The improvement was so good that the balance of the paddock has now been treated, a small triangle left untreated in the centre testifying to the success of the application.

Amounts of Borax to Apply

Boron deficiency can be corrected by the application of borax and this has been standard practice on crops for many years. Amounts used vary somewhat according to the crop, but by and large are as follows:

Brassica crops, 3 to 5 lb per acre when applied with the seed or 12 to 20 lb when broadcast. (However, bringing boron into contact with small seeds at sowing may be detrimental to germination.)

Apples, ½ lb per tree or 50 to 60 lb per acre broadcast.

Hops, ½ oz per hill or 40 to 50 lb per acre broadcast.

Tobacco, 5 lb per acre on sandy soils and up to 10 lb on heavy ones.

The amount and frequency of applications of boron necessary for lucerne and pasture growth are not well known and can be influenced by the amount of leaching which takes place. This again can be influenced by the soil type and rainfall and by application of lime. Boron is extremely mobile in soils and so the deficiency is readily and quickly corrected. At the same time the likelihood of the effect lasting only a short time must not be overlooked.

Trials have now been laid down on lucerne and pasture to investigate correct amounts for application, rates used ranging from 1 lb to 30 lb of borax. How often it should be applied is also being investigated. These experiments are being laid down in different areas and on different soil types as circumstances permit.

The Department of Agriculture and other farmers of the district have reason to be grateful to Mr Holland and those who helped him in his work. It is hoped that others will at least try a strip of borax at 10 or 12 lb per acre where their lucerne or clover is not thriving. At the same time emphasis should be laid on the need for adequate lime, superphosphate, and perhaps potash in the first instance.

Nassella Tussock Controlled in Marlborough

▲ Experimental areas with the main tussock hill block in the background.

▼ Good control with cultivation on the lower slope of a tussock block.

By J. P. BEGGS, Instructor in Agriculture, Blenheim, and W. F. LEONARD, Weeds Research Officer, Christchurch, both of the Department of Agriculture

THE successful control in Marlborough of nassella tussock, one of the country's most dangerous weeds, while a notable victory for modern weedicides, demonstrates the importance of accompanying their use with pasture improvement if the weedkillers are to be properly exploited. It shows, too, the rapid progress that is made when practical application follows closely on research work in the field.

ONLY in the late 1930s was nassella tussock (*Nassella trichotoma*) recognised as a serious weed in New Zealand. However, its spread and depredations since then have been so great that it could now be classed as our No. 1 weed. In 1946 an Act was passed and two boards formed to expedite its control. Since then, in spite of Government grants and subsidies to assist the boards, the weed has continued to spread in some areas.

In Marlborough, where the infestation was not as extensive as that in North Canterbury, control measures were developed and applied, so that nassella tussock has now been very satisfactorily controlled in this district. The research work involved and the control practices carried out are described in this article.

The Problem

The problem facing the Marlborough Nassella Tussock Board was that the nassella tussock had formed a dense nucleus infestation of between 400 and 500 acres on one property and was rapidly spreading in serious proportions over adjacent farms, while scattered plants were appearing on some properties many miles from the nucleus area.

The main factors influencing methods of combating the menace were:

1. Nassella tussock was neglected by stock.
2. It was seeding prolifically. (Healy has shown that an average mature plant produces about 100,000 seeds in a year.)
3. Once established it rapidly formed a complete ground cover and smothered out useful grazing plants.
4. The seed was dispersed readily and extensively, mainly by winds.
5. Nassella tussock withstood dry soil conditions and north-west winds extremely well and thus gained ground when pasture species were deteriorating.
6. It established readily in the open swards normally occurring on dry northerly faces.
7. It was resistant to the usual weedkillers.

Early Efforts

No effective control for nassella tussock could be found for a number of years. The hormone weedkillers 2,4-D and MCPA were tried with no effect, and heavy fertilising to encourage pastures to compete with the nassella tussock was equally ineffective. Arsenical weedkillers and sodium chlorate gave a temporary top kill only.

Though cultivation was a successful counter to nassella tussock on ploughable land, there was no practical

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▲ Heavy growth of clover, lucerne, and grass from oversowing a hard northerly face after a tussock kill with TCA.

▲ This heavy mat of clover stems covering the dead tussock illustrates the exceptionally vigorous growth of oversown species after tussock has been killed with TCA or dalapon.

method of eradication for heavy, hill country infestations. Early efforts were therefore confined largely to the prevention of further spread of the weed by burning to destroy seed before it could blow, grubbing of scattered nassella tussocks, and the prevention of distribution of nassella tussock in farm seeds.

Experiments in Grazing

In 1950 the Department of Agriculture in association with the Marlborough Nassella Tussock Board investigated the feasibility of using the nassella tussock for grazing and at the same time reducing the dissemination of seed. For this work areas of dense nassella tussock were fenced off and stocked separately with sheep and cattle. On a 5½-acre paddock two steers were held and seven wethers were placed on an area of 7 acres. Ample water for the stock was available, but nassella tussock was the only feed, apart from a small amount of danthonia and annual clovers among the nassella tussocks.

On another small area horses were concentrated on heavy nassella tussock and grazed it effectively and prevented seed setting.

Sheep Would Not Survive

Though the steers grazed the nassella tussock sufficiently to prevent most seed setting and at the same time did not drop seriously in condition, the wethers failed to survive when only nassella tussock was left to graze. One sheep died after 7 weeks and the remainder failed so badly later that they had to be removed from the area. Toward the end of the experiment two wethers were left on the 7 acres to see if they would survive at this very low stocking rate (the normal carrying capacity of this country in native pasture is one wether per acre). However, it soon became apparent that the nassella tussock would not support them and they were removed.

The seven wethers were on the area from early August to late December 1950, and two remained until early February 1951.

The conclusions drawn from this trial were that sheep would not survive on country that was completely clothed in nassella tussock, but that cattle could be used successfully to control seed setting.

The success with the grazing of cattle led the Marlborough Nassella Tussock Board to use this system of seed control for several years in place of burning. The results in seed control were quite good, but it was found that heavy grazing tended to lead to complete nassella tussock dominance on areas where useful amounts of good pasture species had existed among the tussocks when grazing started. This was the case also with burning.

TCA and Dalapon

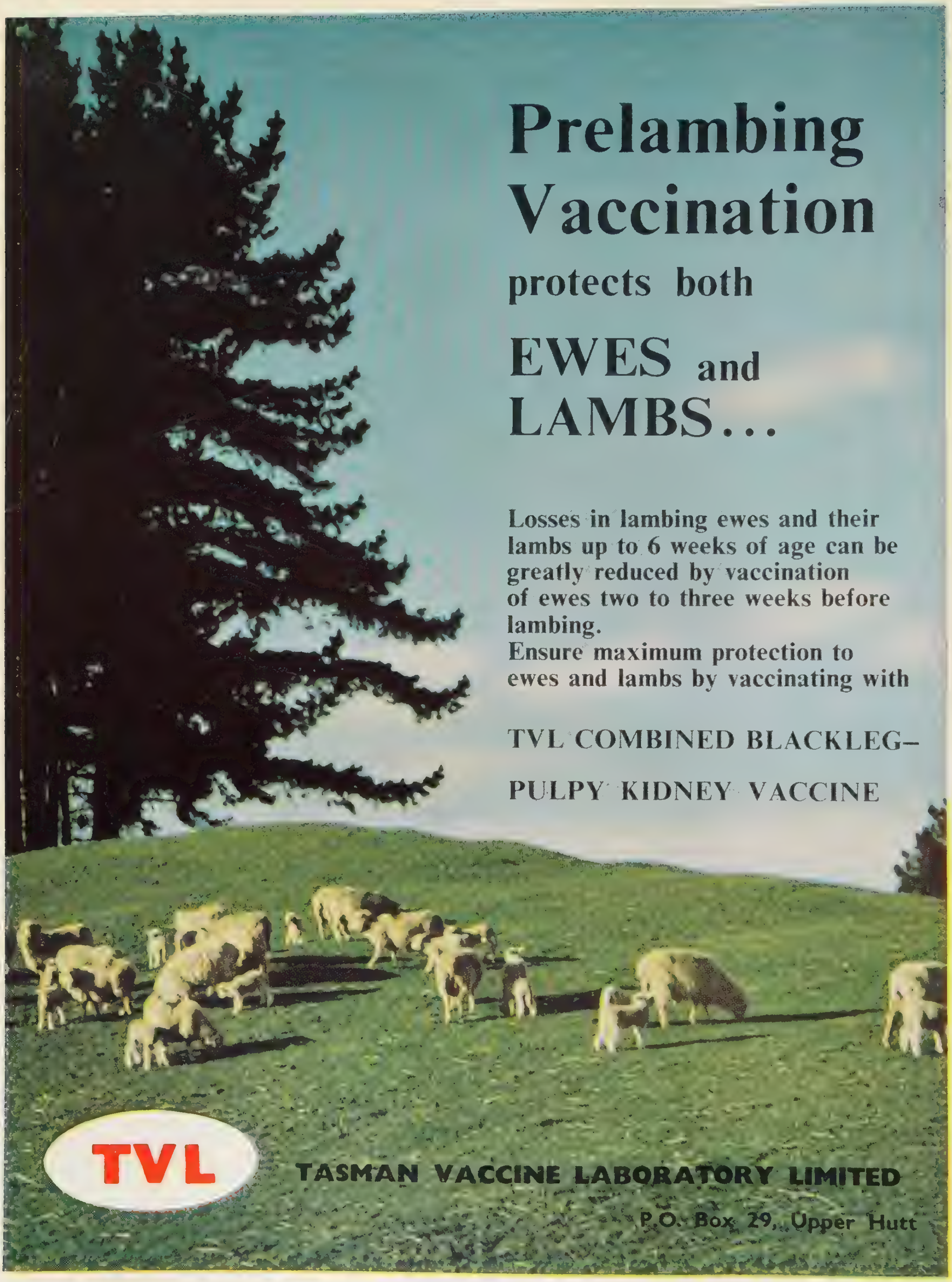
In 1951 the Department of Agriculture began research work with the new weedkiller TCA. At first, results were very variable and disappointing. Amounts as low as 25 to 50 lb per acre gave a good percentage kill in one application at certain times, whereas quantities as high as 200 lb per acre had little effect at other times.

Time of Application

Time of application trials were then started and from these some hope of eradicating nassella tussock emerged.

A trial begun in 1953 showed that a very good kill of nassella tussock was secured from the application of TCA in December, January, and February, but at other times of the year very poor results were obtained. The tussock kill in January reached a peak of 90 per cent with 100 lb of TCA per acre.

Aerial application of TCA on a tussock block is easy and effective.



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A further experiment in 1955 confirmed these results. With 100 lb of TCA per acre as a spray, no kill was secured from April to September inclusive; 5 per cent in October, November, and March; 40 per cent in December; 70 per cent in January, and 80 per cent in February.

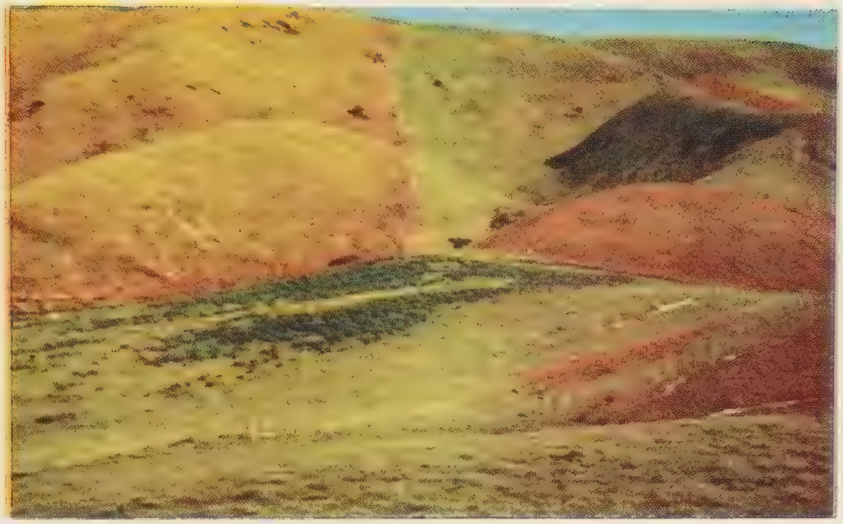
The more recent chemical dalapon gave similarly varying results to TCA in response to time of application. Killing power at equal rates of application was greater than that of TCA and the period over which useful results could be secured was extended. However, in the trials dalapon gave more erratic results than TCA. For example, 50 lb per acre applied in November 1955 gave a kill of 80 per cent. An application in December gave only a 10 per cent kill, but one in January gave a 70 per cent kill. For this strange result from the December application, which was duplicated in another trial the same year, no satisfactory explanation could be obtained. The poor kill in December is not supported by trials laid down in December in other districts.

In two separate trials sprayed on the same day in the same year dalapon was used at 20, 30, 50, and 100 lb per acre. The best kill at 20 lb was 70 per cent in February, while at 30 lb per acre the kill was 80 per cent in October and 70 per cent in February. At 100 lb per acre a maximum kill of 95 per cent was secured in October, November, and February.

October has been a good month for dalapon application in Marlborough and in this respect it differs from TCA. The optimum time for application of TCA is definitely January-February, with fairly good results in December, but poor results at all other times. Dalapon, on the other hand, has performed well in two peak periods—October and February—with good results also in November and January, but with very poor results in December. In the good January-February period 50 lb of dalapon gave the same kill as 100 lb of TCA.

Winter application was most unsatisfactory for both dalapon and TCA at all rates.

From the experience in these trials, with the inexplicably poor results from dalapon in December, it was considered desirable in Marlborough to continue with the use of TCA until further work clarified the anomalous results obtained with dalapon. Should this December result prove to be a freak occurrence only, the use of dalapon instead of TCA would have obvious advantages.


The nucleus area of tussock. In the right background is a 60-acre area after killing of the tussock and oversowing. On the left is dense, untreated tussock.

Replacement of Nassella Tussock

When it became evident that successful killing of nassella tussock was possible, research work toward keeping the weed out and replacing it with useful pasture species was immediately started, for it soon became apparent that when nassella tussock was killed without any follow-up action being taken, reinfestation from seed in the soil soon began.

In February 1954 an area of dense tussock was treated with 200 lb of TCA per acre to ensure virtually 100 per cent kill of the tussock, and a mixture of various grasses and legumes was oversown in April of the same year. In addition, treatments involving heavy applications of fertilisers and lime were included in the hope that some establishment of such drought-resisting species as subterranean clover might be secured to resist the reinfestation of nassella tussock on the hard, dry northerly faces. The original cover of the country concerned under a rainfall of 25 in. was predominantly danthonia with only a trace of annual clovers.

It was surprising, therefore, to find that where subterranean clover was expected white clover, lucerne, and some ryegrass and cocksfoot were secured. The most notable feature was the great vigour of the white clover and lucerne. A complete and vigorous cover of these legumes was secured on the superphosphate 3 cwt plot and little increased benefit resulted from heavier fertiliser rates. Lime at 1 ton

Seedling regrowth in an oversown area.

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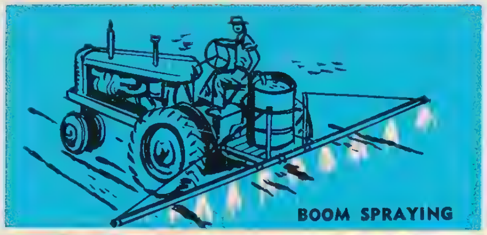

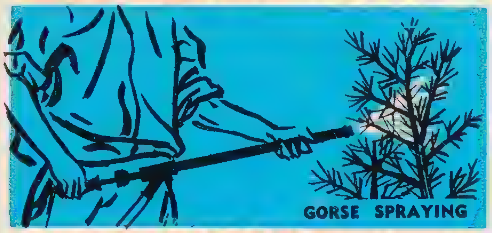

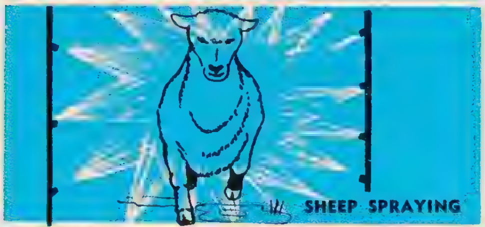

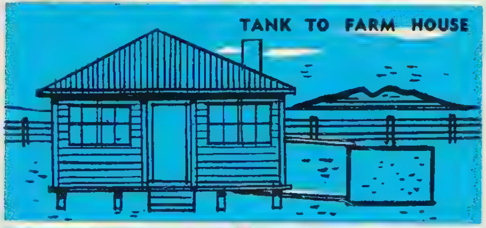

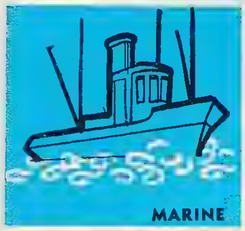

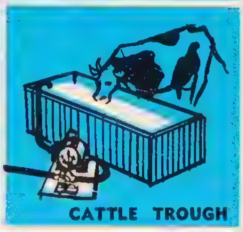

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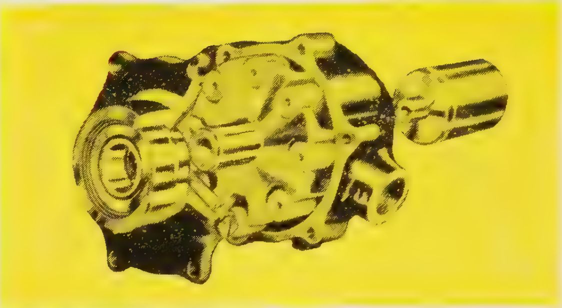

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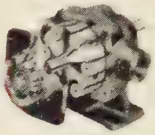

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per acre improved the lucerne somewhat, but made little difference to the white clover.

The outstanding establishment and productivity of the oversown species were obviously due in some way to the action of the weedicide and it has since been assumed that the breakdown of the extensive root system of the tussock resulted in a rapid build-up of soil fertility and at the same time greatly improved the moisture retention power of the soil. The elimination of other plant competition was, of course, a factor. However, the important lesson of this trial was that the way was open, through suitable use of weedicides followed by oversowing, to replace an unproductive and dangerous weed with highly productive pasture.

Control of Seedling Tussock

Nevertheless, it was realised that the tussock would show a tendency in weak parts of the sward to re-establish itself from seed already in the soil following a tussock kill with chemicals, and further investigation to determine the best method of coping with this problem was started.

The results of earlier work were published in the September 1958 issue of "The New Zealand Journal of Agriculture". The main features of this work were that 2½ lb of dalapon or 10 lb of TCA per acre gave virtually 100 per cent kill of seedling nassella tussock without causing excessive damage to the pasture sward.

A further trial laid down in autumn 1958 using TCA and dalapon both singly and in combination at low rates of application is showing promising results and appears to be confirming the findings of the earlier trial work in that 2 lb of dalapon or 10 lb of TCA are the best plots. On these plots a good kill of nassella tussock has been secured without causing any great damage to the sward.

While further work on seedling nassella tussock control would be helpful, it appears from the work done to date that reinfestation of nassella tussock from seed on oversown areas can be satisfactorily controlled with weedicides applied from the air. If this is confirmed on a commercial scale, the control of nassella tussock on a wide scale will be greatly simplified.

Nassella Tussock Board

Following the preliminary results of these trials the Marlborough Nassella Tussock Board set out to eradicate nassella tussock in its district, and the very promising results already achieved by the board will now be described.

Grubbing is still an important method of control for scattered infestations.

As a first step a hill block of 60 acres was treated. Aerial application of TCA at 100 lb per acre was carried out in three stages, 50 lb in December 1954, 25 lb in March 1955, and 25 lb in September of the same year. The TCA was applied as a spray in 10 gallons of water per acre in two runs of the aircraft. Though later experimental evidence indicated that a single January application may have been more effective than the divided December and March treatments, a very good kill was secured and the area was oversown in the following autumn with a grass and clover seed mixture plus superphosphate at 2 cwt per acre.

The scheme was a great success, the outstanding feature being that a mixed sward of high-producing ryegrass, cocksfoot, and clover was produced in one operation on country where the nassella tussock had taken over from a low-producing danthonia sward.

Some subsequent control of surviving large nassella tussocks and seedlings has been necessary, but this has not reached serious proportions.

Next, a block of 100 acres was treated, followed the next year by 225 acres, this completing the elimination of all the dense nassella tussock on the property. On the 100-acre block 25 lb of TCA applied in November 1955 (for seed control) followed by 75 lb in February 1956 gave a kill of virtually 100 per cent. All the treated blocks have now been oversown, the 225-acre block being seeded in April 1958.

Cattle do not like nassella tussock, but heavy stocking with steers will control seed setting.

Time of Oversowing

As there is a time lag of almost a year before the actual percentage kill of nassella tussock can be accurately gauged following treatment with weedicide, the board decided on a policy of delaying oversowing for a year to make sure that the kill was good enough to warrant oversowing. However, in view of the excellent results secured on a plot scale from oversowing in the autumn immediately after treatment, it was decided to conduct a field-scale trial to investigate the position further.

Accordingly, the board seeded a 7-acre area in early May 1956 after TCA application the preceding February. The remainder of the block was sown a year later. Greatly superior results were secured on the early sown area.

It would therefore appear, now that fairly reliable methods of killing the nassella tussock have been evolved, that every effort should be made to secure a high percentage kill with a heavy application of weedicide in the January-February period and then oversow the area in the March or April immediately following.

Tussock Well under Control

As a result of its policy of relentless attack on nassella tussock—in the earlier stages by preventing seeding and later by eradication when it was demonstrated that weedicides would kill the plant—the board now has the tussock well under control. The dense nucleus areas have all been dealt with and the inspectorial staff with its gangs of grubbers ensures that little or no nassella tussock now seeds in the district to produce further infestations.

With effective control of seedling regrowth through aerial spraying in view and with continued prosecution of the policy of strict vigilance and elimination of scattered nassella tussocks now in action, the stage is set for virtual eradication of nassella tussock in the Marlborough district. This is indeed a bright prospect compared with that facing the board 10 years ago.

General Recommendations

Surviving nassella tussocks in a partly killed stand are thereafter much more difficult to kill with weedicide. This is probably due to the build-up in fertility following the decay of the extensive root systems of surrounding plants. Therefore, every effort should be made to secure as complete a kill as possible with one heavy application of weedicide at the most appropriate time.

All the experience to date in Marlborough indicates that the most suitable method of replacing nassella tussock with pasture under local conditions using TCA is as follows:

1. Apply 25 lb of TCA at the end of September (for seed control).

2. Apply 100 lb at the end of January (main kill).

3. Oversow grass and clover the following April.

At present prices the TCA treatment would cost £16 10s. per acre.

Using dalapon, the same system would apply, the endeavour being to secure a high percentage kill with a heavy application in the January-February period. For seed control about 10 lb of dalapon per acre would be suitable, followed by a 50 lb per acre treatment for the main kill.

Should further work prove a greater reliability of dalapon than that indicated by the trials described, the use of this material in one heavy application in October would have considerable merit. Used in this way no separate seeding control application would be necessary and it would also be possible to apply a follow-up treatment of either TCA or dalapon in the following February if required before oversowing the same autumn.

The Future

The task of controlling nassella tussock in Marlborough has been a big one and much work is still to be done in preventing nassella tussock from getting away again as a result of the establishment of new plants from seed already in the ground. However, to date results of the board's work have been extremely gratifying and satisfactory control of nassella tussock has been demonstrated on a practical scale.

Further work with weedicides will undoubtedly bring increased efficiency in dealing with this troublesome weed. In one trial laid down in February 1957 dalapon at rates as low as 10 lb per acre gave a 100 per cent kill of dense nassella tussock. This occurred on young regrowth nassella tussock after a burn. Further work may confirm that dalapon is a much more efficient killer when used in this way. It is therefore probably not too much to say that, with our growing knowledge, virtual eradication of this serious weed may become feasible in the not too distant future.

Weed Control in Lucerne

WEEDS which are a problem in newly established areas of lucerne are mainly annuals which may gain the upper hand before the lucerne has had a chance to establish. Such weeds can be controlled to some extent by factors of management such as thorough soil preparation and sowing at the most suitable time of the year.

However, weeds such as fathen often infest young lucerne stands and the use of a selective weedkiller is sometimes warranted. Of the various weedkillers available 2,4-DB is the most suitable, as it is effective and is the least damaging to lucerne.

Spraying should be done at an early stage of growth provided there is a complete ground cover. A suitable rate of application is 1 lb acid equivalent per acre.

Established stands commonly suffer from infestation with grasses such as browntop, creeping bent, *Poa annua*, Yorkshire fog, and ryegrass. Dalapon at rates of up to 5 lb per acre in 20 gallons of water has provided satisfactory control of these grasses except that where perennial ryegrass is encountered, the rate of dalapon must be increased to about 7 lb per acre, but even then control is not always satisfactory. Lucerne is likely to suffer lasting damage if dalapon is applied at much more than 7 lb per acre.

Least Damage in Early Spring

Least damage from dalapon application is suffered if it is applied in early spring when there is little foliage on the lucerne. Satisfactory grass control is secured at this time of the year. One interesting feature of grass control with dalapon is that, on certain paddocks which had previously been kept for seed, seedling lucerne plants have appeared in the spaces between mature lucerne plants where the grasses were.

Before setting out to rejuvenate a "run-out" lucerne stand with weedkillers farmers should satisfy themselves that some fertility factor is not limiting the vigour of the lucerne crop. Should a soil deficiency reduce its vigour, the lucerne crop loses its ability to compete successfully and allows the lower-fertility species to establish.

—*W. F. LEONARD,*

Weeds Research Officer,
Department of Agriculture,
Christchurch

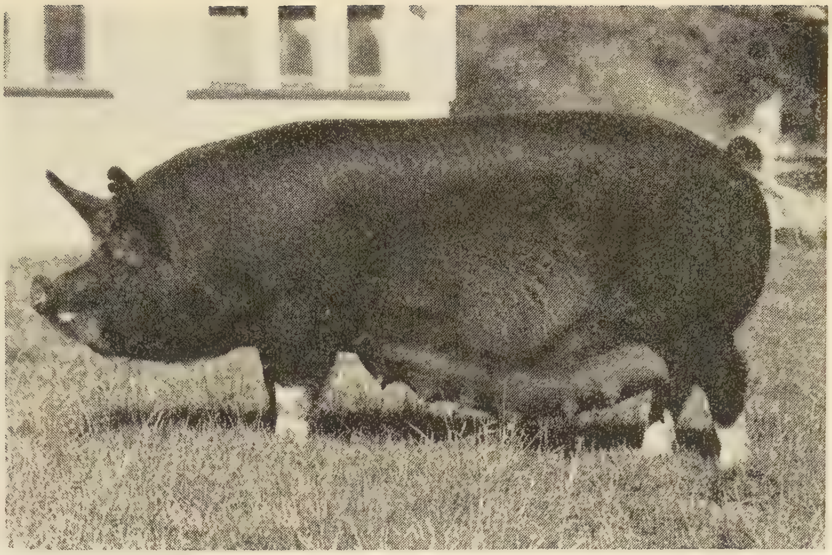
The Essentials of Efficient Pig Feeding

THE need for farrowing down sows within the two months before the beginning of calving to obtain the best fit of pig numbers and size to the supply of milk or whey was emphasised in last month's issue of the "Journal" by I. H. Owtram. This is probably the most important feature in pig management on the dairy farm. For maximum profits, though, it must be accompanied by sound feeding of the resultant pig crop. This article by E. D. Edwards, Technical Officer, Department of Agriculture, Wellington, discusses feeding methods desirable for a high turnover of good-quality pigs.

THE task of feeding growing pigs really begins a month before their birth, since at this stage their rate of development is significantly affected by the nourishment they receive from the sow. The sow's ration during this period should include adequate protein in the form of milk, milk powder, or meat meal to allow the foetus to develop fully. Well developed piglets having birth weights of 2 lb or more are much less affected by cold weather and make better progress than do smaller piglets.

It is not suggested that farmers weigh all pigs at birth, but the periodic use of scales at birth, at weaning, and at convenient stages during fattening gives the only reliable measure of response to feeding methods and is valuable in marketing pigs.

In the fattening process the aim is to have the pigs grow rapidly, but economically, and to yield a carcass which will meet the approval of the consumer.



▲ The feeding of growing pigs really begins a month before birth with the feeding of the sow. The sow illustrated is in ideal farrowing condition.

The feeding policy most likely to give this result is one which takes into account the form of growth in pigs and the manner in which food is used by the pigs.

Principles of Growth

Dr C. P. McMeekan's experiments in 1940 showed that pigs grow by a series of waves starting from the head, the extremities of the limbs, and from the tail and meeting in the loin.

Of the three main tissues, bone reaches the maximum rate of growth first, then muscle, and lastly fat. Pigs stunted in early life and then fed well tend to have small bones, poorly developed muscle, and an excessive proportion of fat. Pigs which are fed well early in life and afterward on a restricted diet have well developed bone and muscle but only a moderate covering of fat at the same body weight.

Food consumed by the pig has first to meet maintenance requirements such as repairing tissues, exercise, and keeping warm, and the important point is that this requirement increases as the pig grows. Only food surplus to maintenance requirements can be used for growth.

Feeding designed to promote rapid early growth and later moderate growth is thus desirable for two reasons—economic food usage and a carcass of good quality.

Feeding Policy

To get two litters per sow away each year under the breeding programme based on May and November farrowings, meals and crops have to be used to ensure that all pigs get an adequate ration at all times.

This plan requires careful feeding and good control over the pigs to be effective. Lest it should leave the impression of being an expensive method of keeping pigs, the production figures obtained by one farmer who has followed it conscientiously in recent years and whose pigs have been sold over the hooks are quoted in the table on page 549. These results were obtained on an 80-cow, home-separation, two-man farm during the 1955-56 season.

Note the following points:

1. The concentration of farrowings ahead of the main calving period.

2. The extent to which meal is used to bridge the gap in food supply both for sows and litters over winter.

3. All pigs reared were sold as fat pigs.

4. Pig meat produced amounted to 16,633 lb, which if valued at 1s. 3d. per pound returns £1,040, less £130 for meal.

5. Meal is used at the rate of 8½ cwt per sow carried.

6. Selected pigs have been prize-winners in local porker and baconer competitions.

This is an illustration of what can be done when the piggery is well organised and fattening pigs are kept growing steadily right from the start without overfeeding on liquids at any stage. The low number of deaths reflects the good health of the pigs.

The daily ration is not tied to any particular scale, but is based on the appearance and progress of the pigs, which are weighed periodically and

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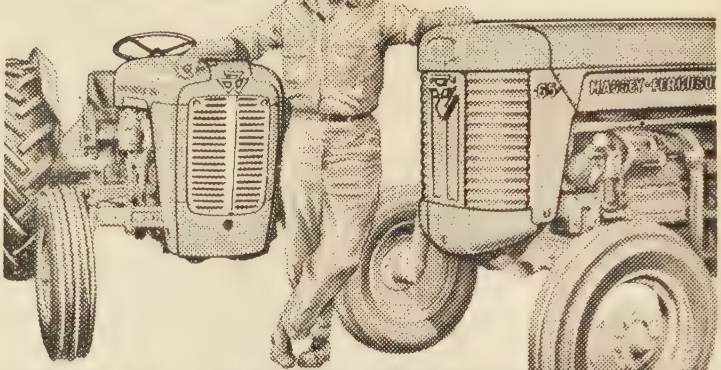

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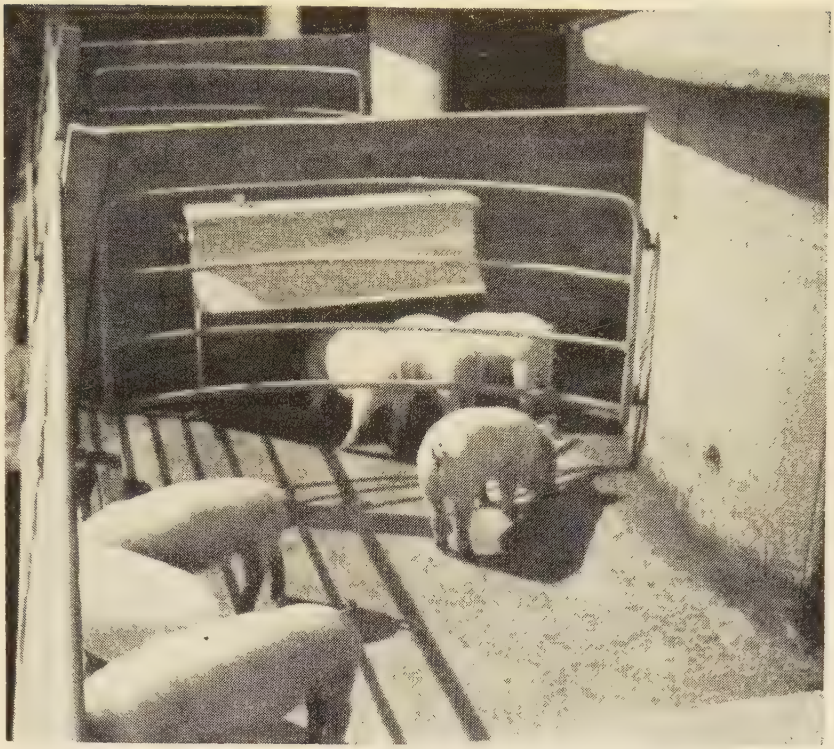
RESULTS OBTAINED ON FARM ON WHICH BREEDING PROGRAMME IS BASED ON MAY AND NOVEMBER FARROWINGS

	June	July	August	September	October	November	December	January	February	March	April	May
Pigs on hand at beginning of month	10 (9 sows, 1 boar)	37	86	86	86	78	82	118	89	82	56	26
Pigs born during month	30	56				27	63					
Number of sows farrowed	3	6				2	6					
Number of pigs died	3	7				2	9	1		1		
Number of pigs sold and weight:												
Porkers					7 (650)	21 (1,997)	12 (1,168)		7 (525)	23 (2,061)	30 (2,735)	8 (765)
Baconers							6 (777)	28 (4,178)				7 (826)
Others					1 (232)					2 (598)		
Pigs on hand at end of month	37	86	86	86	78	82	118	89	82	56	26	11
Supplement used:												
Meat meal	10 cwt	15 cwt	11 cwt	10 cwt	5 cwt	5 cwt	5 cwt	5 cwt	1 cwt	4 cwt	3 cwt	2 cwt
Fodder beet		30 cwt	15 cwt									
Butterfat for month	313	87	1,072	2,493	3,505	3,504	3,555	3,450	3,345	2,645	1,574	956
Average daily labour requirement (minutes)	66	112	81	66	70	91	85	68	58	45	45	40

This farmer on skim milk earns £100 per sow after costing meal. Note the farrowing periods and supplements used to get away two litters per sow, with an August calving.



Meal or pellets in a creep should always be available to the suckers from a fortnight after birth. Meal consumed at this period is used very efficiently and promotes rapid growth.

particularly as they approach slaughter weight.

Improving Meat Quality

The quality of bacon available to the consumer continues to be criticised and in respect of the proportion and type of fat this can largely be remedied with better feeding methods. There is no doubt that the policy of wintering pigs on insufficient rations results in the bacon curer having to accept many pigs with excessive fat covering. If there is a temporary shortage of pigs, it would be a better policy to preserve surplus milk as curd than to overfeed the pigs. However, in the long run a farrowing policy as illustrated in the table at left would prove the most profitable method of overcoming this problem. It aims at doing the pigs well so that they put on plenty of meat before fat development takes charge. Quickly grown pigs have a firmer fat than do slowly grown pigs.

A soft and perhaps tainted fat may be caused also by the feeding of fish oils to pigs near to time of slaughter. With porkers the feeding of fish oils should cease at least a week before slaughter. With baconers stop using the oils at 100 lb liveweight. A standard dose of ¼ fl. oz. per pig per day would be satisfactory. Tallow at 2 to 4 oz per pig daily may be used with or in place of the oil.

A Feeding Guide

With the new season about to begin very little can be done in altering the farrowing programme, but a start can be made to improve feeding methods if these are limiting output.

Check the following guide to feeding and compare it with your methods. Most farmers will find they could benefit by feeding more meal in the early stages and by keeping the intake of milk or whey just below appetite level. Careful rationing of the food fed to baconers to give 1¼ lb liveweight increase per day will produce the maximum weight of quality meat per food unit.

1. Feed the sow well during lactation. Increase her ration gradually, reaching a maximum about two weeks after farrowing, when she should receive 4½ units for herself plus 1 unit for each pig suckled. (One food unit = 1 gallon of skim milk or 1½ gallons of whey or 1 lb of meal)

2. Put meal or pellets in a creep for the suckers so that it is always available to them.

3. Allow the suckers access to clean turf as soon as possible.

4. Winter litters may be weaned at three weeks if well grown and conditions are favourable. Otherwise wean them at six to eight weeks.

Short pigs and those which will not produce top grade baconer carcasses should be sold as porkers. Several of the pigs shown above would be unsuitable as baconers.

5. Meal feeding must be continued after weaning, especially if there is a shortage of milk or whey.

6. When skim milk is plentiful weaners should receive ½ lb of meal per pig, ceasing after three months of age. On whey, 1¼ lb of meal is desirable at weaning, dropping to 1 lb after three weeks and remaining at this level until baconer stage is reached.

7. When the supply of milk or whey is falling in the autumn, meal could form the bulk of the ration for pigs nearing pork weight.

8. Meals high in protein such as the milk powders and meat meal are preferable during the very early stages and when milk or whey is in short supply. They can be replaced by meals lower in protein at other times.

9. The maximum ration for top-weight baconers should be 6 gallons of milk or 9 gallons of whey. A tendency to overfatness in some pigs will require a reduction in rations from 140 lb liveweight; otherwise they should be sold as porkers.

10. Rations for fattening pigs:

Liveweight lb	Feed units
40	2
60	2.75
80	3.25
100	3.75
120	4.25
140	4.75
160	5.25
180	5.75

It is essential to see that a profitable return is being obtained for the food used. Liveweight gains should be 1 lb daily up to the 80 lb stage and thereafter increase until at 140 lb they should reach 1¼ lb liveweight daily. Thereafter this daily rate of gain should be maintained until slaughter. Any pigs which will not produce top grade carcasses when grown as fast as this should go off as porkers.

Economic Importance of Careful Feeding

In seeking maximum profits from pigs, feeding must aim at

(a) Maintaining health. Dead pigs are a dead loss, and unhealthy pigs not only waste food, but their carcasses may be wholly or partly condemned.

(b) Using farm-produced foods to best advantage. These seasonal, low-cost foods are used more efficiently when suitably balanced with purchased foods. Feeding on this basis is essential for maximum meat production and economy in use of breeding stock and buildings.

(c) Producing carcasses of high quality. Meat of high quality will always sell readily and is generally more profitable to produce for present-day markets than meat of inferior quality.

(d) An adequate reward for labour. Feeding methods which encourage rapid growth in pigs give a quick turnover in stock. When pigs spend less time on the farm there is a saving in labour.

Improving Unploughable Tussock Country

THE introduction of high-producing clovers is essential for improving the production and cover on tussock country in areas where the rainfall is above 25 in. annually. Results obtained in recent years have shown that spectacular improvement of tussock country can be brought about by aerial oversowing and topdressing.

Inoculated clover seed with adequate fertilisers should be sown so that the clovers will grow vigorously. After the fertility level has been built up higher-fertility-demanding grasses such as cocksfoot can be introduced. Recommended seeding rates are 2 lb of Montgomery red clover for summer production, with 2 lb of white clover and 2 lb of alsike clover per acre for production over a longer period.

Most tussock country is deficient in sulphur and phosphorus, and on some soils derived from greywacke parent material molybdenum is deficient. In areas of Otago on soils derived from mica-schist parent material molybdenum is not a limiting factor. If there is a distinct sulphur deficiency, 1 cwt of fortified superphosphate (400 lb of sulphur per ton) per acre is recommended.

In other areas where phosphorus is also a limiting factor 1½ to 2 cwt of superphosphate per acre is satisfactory. Inoculation of the clover seed to aid establishment is important.

Results have shown that June and July are the best times for oversowing tussock country so that the seed is washed into and also incorporated in the soil by frost action. If oversowing is done at this time, the fertilisers are available when required by the young plants. The areas that are to be improved should not be burnt or overgrazed or the protection for the young plants will be destroyed. The treated areas should be spelled during the establishment period and also during the seeding period in the first year.

—*T. E. LUDECKE,*

Research Officer,

Department of Agriculture,

Alexandra

Winter Show Dates

16, 17, 18, 19, and 20 June—Whangarei A. and P. Winter Exhibition at Whangarei.

26, 27, 28, and 29 August—Whakatane A. and P. at Whakatane.

Damage to Pastures by Wheat-stem Weevil

By C. P. WHATMAN,
Instructor in Agriculture, Department of Agriculture, Ashburton

CANTERBURY pastures dominant in ryegrass (particularly short-rotation or Italian) commonly die out or become severely weakened during a hot, dry summer. The plant mortality has usually been directly attributed to drought. Though this occasionally may be the reason, more frequently the effects of the drought are intensified by the activities of pests. Of these, one of the most common and most destructive is the beetle *Hyperodes griseus*, known variously as wheat-stem weevil, Argentine stem weevil, or *Hyperodes*.

THE damage caused by the wheat-stem weevil is insidious in that it is not noticed during dry weather; it is apparent only when the pasture fails to recover after rain.

Both the adult and the larva are responsible for damage. In pasture the damage caused by the adult is somewhat minor, being confined to the stripping of surface layers from leaves, particularly toward the tip. This gives a silvery appearance to pasture, but damage is superficial and recovery of plants is usually good.

Hyperodes griseus larva and pupa (X15). The larvae are responsible for severe damage to grasses, particularly short-rotation and Italian ryegrass.

In germinating cruciferous crops the adults do serious damage. During recent dry summers many newly sown turnip crops have failed to establish owing to the depredations of this insect.

The main damage to pasture is done during the larval stage of the weevil. Eggs are laid in the leaf sheaths and leaves and, on hatching, the larvae tunnel into the young growing tissue of the tillers. The presence of a single larva per tiller is sufficient to destroy that tiller. Under a severe infestation all tillers are killed.

Infestation may occur in autumn in newly sown stands or in stands a year or more old. Stands harvested for seed are particularly susceptible. Short-rotation and Italian ryegrass suffer more severely than perennial.

A third type of damage is seen in seed stands before harvest. The presence of "white heads", which do not set seed, is often due to a *Hyperodes* grub in the stem. Losses from this cause are rarely serious.

Though the insect is called wheat-stem weevil, little damage is usually done to wheat or other cereals in this country, probably because of the late autumn sowing and the vigorous growth normal in our wheat crops in spring.

Life History

The adult weevil, a greyish beetle about ⅛ in. long, is present in the soil at all times of the year. It is very difficult to see, as, apart from its colouring being similar to that of the soil, it becomes covered with fine particles of dust. When disturbed it frequently "plays possum" for long periods, during which it is almost impossible to see.

After overwintering in the pasture the adults lay eggs from the end of August to early November. The next generation lays eggs during the latter part of December and until the end of March.

Eggs hatch into larvae which tunnel into the leaf sheaths before entering the tillers, where they complete their development. When fully fed the larvae, then 3/16 in. long, cut holes in the side of the tiller or straw and drop to the ground, where they pupate under plant cover at or near the ground surface. The pupation period is relatively brief, adults emerging after 7 to 15 days.

Hyperodes griseus adults (X15). These weevils cause severe damage to germinating turnip crops in a dry season.

Control

Damage by adults to germinating cruciferous crops is easy to control. They are susceptible to both lindane and DDT and ¼ to ½ lb of lindane (1 to 2 pints of 20 per cent lindane emulsion per acre) sprayed on to the bare ground after sowing or the application of ½ to 1 lb of 100 per cent p.p.i.

DDT in dust or spray will be very efficient.

Larvae, being well protected inside the tillers, cannot be reached by spray or dust. Officers of the Department of Agriculture, Timaru, in association with the Entomology Division of the Department of Scientific and Industrial Research, investigated the effect on the pest of systemic insecticides, three forms of which were used at varying rates, but results were completely negative.

The work of Dr B. R. Watkin, of the Department of Scientific and Industrial Research, Lincoln, shows that positive control can be obtained by the elimination of the adults before egg laying. This involves treatment with 1 lb per acre of lindane or 100 per cent p.p.i. DDT during the last two weeks of August to kill overwintering adults or in the first two weeks of December to kill the second generation adults.

New sowings of grass can best be protected by treatment with DDT immediately after sowing. The application of 2 lb of 100 per cent p.p.i. DDT will have the dual effect of killing *Hyperodes* adults, thus preventing egg laying, and proofing the pasture against grass grub and porina attack for the following two to three years.

There are two drawbacks to the treatment of established pasture. In the first place cover on the ground at the recommended times for treatment is likely to be fairly dense. This is certain to be so in December in stands shut for seed. Spraying may not be effective through the spray material not reaching the ground. Dusting with DDT (for instance, by applying DDT superphosphate) would then probably be more effective. In the second place, since treatment has to be done in advance of damage showing up, farmers may not be prepared to go to the expense of this preventive measure.

Control of, though not the elimination of, the pest can often be obtained by indirect means. Since short-rotation and Italian ryegrass are most susceptible, they should be replaced in areas where damage is frequent by species less vulnerable such as perennial ryegrass, cocksfoot, timothy, and dogstail. Grass to grass techniques should be avoided in areas where *Hyperodes* is common. A rotation which includes a cruciferous crop and a bare fallow of three months or more will considerably reduce the likelihood of a new pasture being attacked.

Acknowledgment

The writer is indebted to Mr J. M. Kelsey, of the Department of Scientific and Industrial Research, Entomological Research Station, Lincoln, for his assistance in the writing of this article. The result of a three-year survey by Mr Kelsey of the damage done by *Hyperodes griseus* was published in the October 1958 issue of the "New Zealand Journal of Agricultural Research".

◆

Radio Broadcasts for Farmers

RADIO broadcasts for farmers will be given during July as follows:

1YA Auckland, 7.45 p.m.

2 July—"Leptospirosis", by A. Fisher, Veterinarian, Department of Agriculture, Auckland.

9 July—"Eradicating Dangerous Weeds", by E. H. Arnold, Assistant Fields Superintendent, Department of Agriculture, Auckland.

16 July—"Vaccines Needed for Sheep", by G. Wallace, Veterinarian, Department of Agriculture, Auckland.

23 July—"Sod Seeding", by C. M. Blick, Fields Instructor, Department of Agriculture, Warkworth

30 July—"Feeding Calves", by E. Nelson, Livestock Instructor, Department of Agriculture, Papakura

1YZ Rotorua, 7.15 p.m.

1 July—"Domestic Beekeeping", by D. A Briscoe, Apiary Instructor, Department of Agriculture, Tauranga.

15 July—"The Rearing of Dairy Calves", by E. O. Pederson, Livestock Instructor, Department of Agriculture, Whakatane

29 July—"Quality Faults in Milk and Cream", by E. P. Carter, Special Inspector, Department of Agriculture, Hamilton.

1XH Hamilton, 12.33 p.m.

13 July—"Pulpy Kidney in Sheep", by D. Bilkey, Livestock Instructor, Department of Agriculture, Hamilton

20 July—"Insect Pests and Diseases in the Home Garden", by E. E. Toleman, Horticultural Instructor, Department of Agriculture, Hamilton.

27 July—"Some Aspects of Weed Control", by J. R. Murray, Instructor in Agriculture, Department of Agriculture, Hamilton

2XA Wanganui, 8 p.m.

2 July—"For the Country Woman", by Mary MacDonald.

16 July—"Treatment of Sows and Their Litters", by C. M. Bailey, Supervisor, Taranaki District Pig Council.

23 July—"Research with Fertilisers on Gabo Wheat", by A. K. Booth, Instructor in Agriculture, Department of Agriculture, Wanganui

30 July—"The Use of Fertilisers in Market Gardens", by R. A. S. Waters, Instructor in Horticulture, Department of Agriculture, Palmerston North

2YZ Napier, 7.10 p.m.

7 July—"Preparation of Meat for North American Markets", by Z. V. Warren, Meat Inspector, Department of Agriculture, Hastings.

21 July—"Potato Growing", by A. J. Coughlan, Fields Instructor, Department of Agriculture, Hastings.

2ZA Palmerston North, 12.36 p.m.

6 July—"Wheat Growing in the Manawatu", by J. A. Graham, Instructor in Agriculture, Department of Agriculture, Palmerston North.

20 July—"Weed Control in Vegetables", by G. N. Paulin, Horticultural Instructor, Department of Agriculture, Palmerston North

3YA Christchurch, 12.20 p.m.

6 July—"Glasshouse Tomatoes", by L. C. Hurndell, Horticultural Instructor, Department of Agriculture, Christchurch

20 July—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin and 4YZ Invercargill, 12.36 p.m.

6 July—"Oversowing Tussock Country", by T. E. Ludecke, Research Officer, Department of Agriculture, Alexandra.

13 July—"Management of Chicks", by M. E Sutton, Poultry Instructor, Department of Agriculture, Dunedin.

20 July—"Early Spring Feed", by W. Faithful, Instructor in Agriculture, Department of Agriculture, Invercargill.

27 July—"Lambing Problems", by C. E Isaacs, Veterinarian, Department of Agriculture, Invercargill.

Regular Sessions

1YA Auckland, Mondays at 12.36 p.m ("Country Journal", including "Report from Ruakura"), Tuesdays, Wednesdays, Thursdays, and Fridays at 7.45 p.m. ("Country Journal"), Thursdays at 12.33 p.m. ("News for the Farmer").

1XN Whangarei, Mondays at 8 p.m. ("Northland Stock Market Report" followed by "Farming for Profit"), Wednesdays at 8 p.m ("Farming for Profit"), and Fridays at 12.33 p.m. ("Farm News").

1XH Hamilton, Mondays at 12.36 p.m. ("For the Farmer", excluding first Monday in month and public holidays), Wednesdays at 12.33 p m ("Report from Ruakura").

1YZ Rotorua, Wednesdays at 7 p.m. ("Bay of Plenty Journal"), Thursdays, 12.33 p.m ("News for the Farmer").

2YZ Napier, Tuesdays at 7.10 p.m. ("The Hawke's Bay Farmer") and Thursdays at 12.33 p.m. ("News for the Farmer").

2XG Gisborne, Tuesdays at 8 p.m. ("Farm Session").

2XP New Plymouth, Fridays at 8 p.m ("Farm Session").

2XA Wanganui, Mondays at 8 p.m. ("For the Man on the Land"), Tuesdays at 8 p.m ("Farm Supplement"), and Thursdays at 8 p.m. ("Farm Topics").

2XB Masterton, Fridays at 6.45 p.m ("Farm Session").

2XN Nelson, Thursdays at 8 p.m. ("Nelson Farm Topics").

2ZA Palmerston North, Mondays at 12.36 p.m. ("Country Digest") and Fridays at 8.30 p.m. ("Country Digest", including Feilding stock market report).

2YA Wellington, Mondays, Tuesdays, and Fridays at 7.10 p.m. ("Farm Session"), Thursdays at 12.33 p.m. ("News for the Farmer")

3YA Christchurch, Mondays at 12.20 p.m ("Country Session"), Thursdays at 12.33 p.m ("News for the Farmer") and 7.10 p.m ("Home Paddock").

3XC Timaru, Wednesdays at 8 p.m ("Farmers' Weekly News Service") and Saturdays at 10.30 a.m. ("Country Mailbag").

3YZ Greymouth, Mondays at 12.36 p.m., Thursdays at 12.33 p.m. ("News for the Farmer").

4YA Dunedin, Mondays at 12.36 p.m., Wednesdays at 12.33 p.m., and Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.36 p.m., Wednesdays at 12.33 p.m., and Thursdays at 12.33 p.m. ("News for the Farmer").

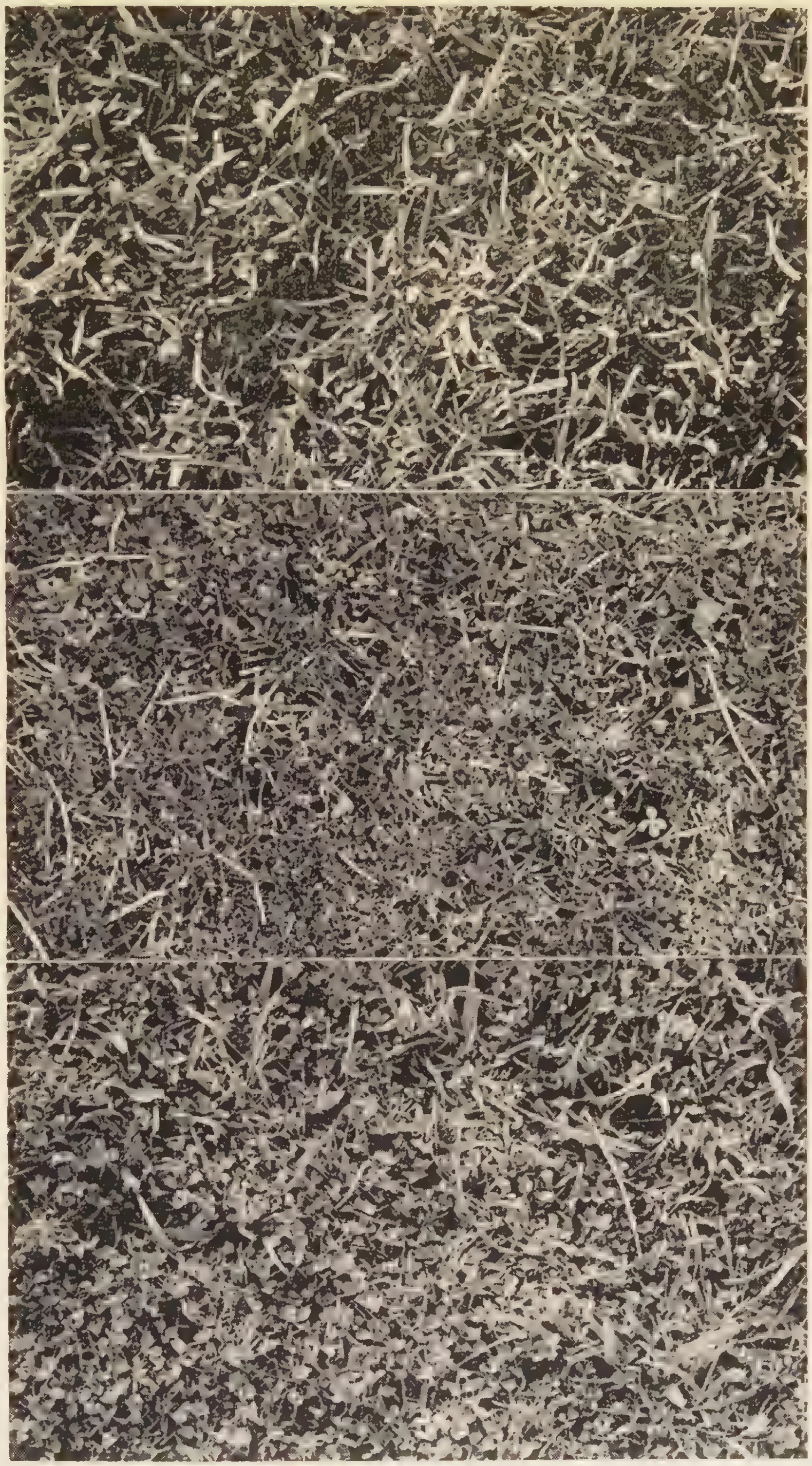
◆

Phalaris tuberosa in Hawke's Bay

By G. M. BENNETT,
Instructor in Agriculture,
Department of Agriculture,
Hastings

WITH the constantly improving technique of coping with annual climatic fluctuations by the use of various grass species more suited to certain times of the year in specific districts, Australian Toowoomba grass (*Phalaris tuberosa*) is finding a useful and important place in Hawke's Bay pastures, particularly on the lighter soils of the low-rainfall areas.

SOME years ago, and possibly even still today, many farmers were confusing *Phalaris tuberosa* with several other plants of the same family, principally lesser canary grass (*P. minor*) and canary grass (*P. canariensis*).



PASTURE IMPROVEMENT IN HAWKE'S BAY →

Top—A section of a well established sward of a properly combined *Phalaris tuberosa* pasture. Middle—A perennial ryegrass and subterranean clover pasture typical of the more common swards on Hawke's Bay light land. Bottom—A poorly established pasture obtained from sowing a mixture of *P. tuberosa* and ryegrass. The insufficient coverage of *P. tuberosa* and other grasses has allowed subterranean clover to become dominant.

The last two are annual species usually regarded as weeds, since they are low producing and rely on re-seeding each summer to maintain their existence by germinating and re-establishing themselves the following autumn. They are shallow-rooting plants and do not have the dry land value of *P. tuberosa.* Consequently this confusion earned *P. tuberosa* a bad name in comparison with other higher-producing grasses such as cocksfoot.

Until recently *P. tuberosa* has not been sown to any great extent within the Hawke's Bay Land District. The New Zealand and Australian Departments of Agriculture now include *P. tuberosa* in their certification schemes, and this guarantees the purchase of seed of pure strain.

In the Hawke's Bay district investigations have been carried out into the performance of *P. tuberosa* over several years, using a "rate of growth" trial on a paddock scale on a property producing fat lambs in the Maraekakaho district.

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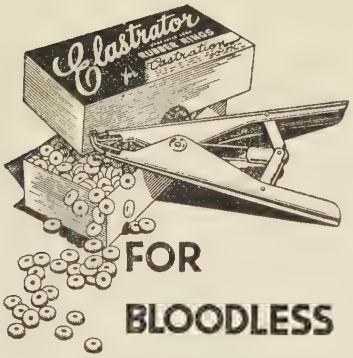

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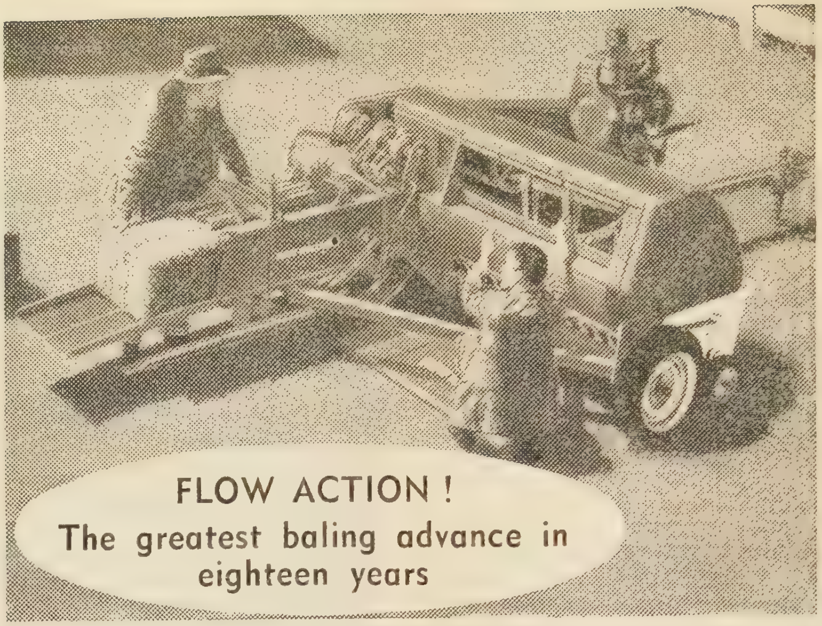

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As a result of this trial and on general district observation it has been clearly established that *P. tuberosa* as a combination species on medium to light soil types, particularly where late summer is the worst growth period, has a most valuable place and should be used to a much greater extent that it is at present.

Recommended Utilisation

Whereas perennial ryegrass is normally a relatively shallow-rooting grass, *P. tuberosa* will root much more deeply to obtain the moisture it requires.

Apart from this physiological feature of *P. tuberosa* it is an extremely palatable grass provided it is kept short, being selectively grazed by sheep, even in preference to perennial ryegrass.

As it grows in Hawke's Bay at a favourable rate compared with more common species and is reasonably easily sown down and managed, it will be a welcome addition to many pastures. Owing to its deeper rooting system *P. tuberosa* has been the only green grass species still prominent in Hawke's Bay pastures after a dry summer.

For this reason and because light soils dry out more rapidly and severely than do heavier soils, *P. tuberosa* is most effectively used on the medium to light soils such as Mangatahi, Takapau, and Matapiro sandy silt loams. This applies particularly where autumn rains are infrequent and insufficient for quick ryegrass and white clover recovery in autumn.

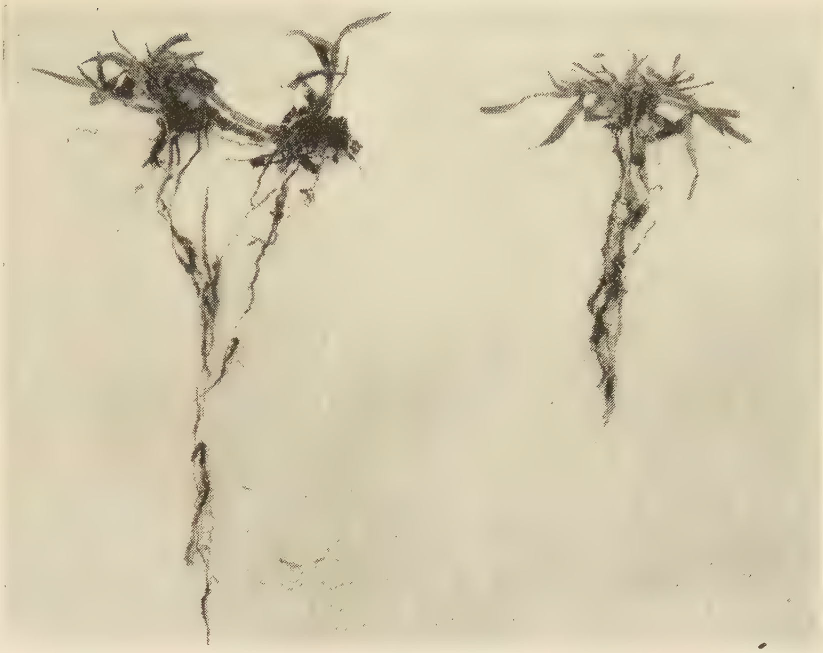
On the heavier, more moist soils of Hawke's Bay, such as Hastings clay and silt loams on the Heretaunga Plains, the widespread use of *P. tuberosa* is not recommended, since other grass species, principally perennial and short-rotation ryegrass, cocksfoot, and white and red clover persist quite suitably and, under those conditions, produce a greater bulk of feed than does *P. tuberosa*.

For Seed

If sown fairly heavily (7 lb of certified seed per acre), *P. tuberosa* can be shut for seed, though it grows extremely rank, up to 6 ft in height, with a resultant opening up of the pasture sward. This opening up of the pasture, owing to the clumpy nature of matured *P. tuberosa*, will allow weeds to establish the following autumn and spring. Consequently, as seed production results in a general weakening of the plant, shutting for seed is recommended only where it is intended to renew or change the paddock cover the following year.

For Hay

P. tuberosa is very leafy as a closely grazed grass, and so is comparatively high in food value. It is also low in moisture content, as was proved by its dry matter content being fairly consistently higher than that of perennial ryegrass throughout the three years of the trial at Maraekakaho. For these reasons it makes excellent hay, being preferred by sheep, in one farmer's experience during a small trial of his own, to good-quality lucerne, meadow, and clover hays, and even pea silage.



Left—A *P. tuberosa* plant, showing the rhizomatous nature of this species (the full length of the roots is not shown). Right—A perennial ryegrass plant. Both plants were taken from the trial area.

Because of its growth habit and performance *P. tuberosa* requires special management for best results; for example, when it is to be used for hay it should be cut at a height of 12 to 14 in., certainly before the plant begins to set seed or flower.

If left to get too mature, *P. tuberosa* will become stemmy and drop in food value, leaving an open and tufty pasture. The autumn recovery will then be slow and dry, and sheep and cattle will really have to chew out the old stalks to allow new, green tillers to grow. When cut reasonably immature the grass dries easily under favourable weather conditions and makes first-class hay.

Grazing

Once *P. tuberosa* is properly established, its grazing management can be severe without unfavourable results. Because of its palatability it is usually close grazed during summer, but it recovers remarkably well the following autumn under still, semi-dry conditions, and will also produce well during winter.

Comparison with Perennial Ryegrass

The accompanying graph records the results of the rate of growth trial at Maraekakaho from which much valuable information is available on the production of a *P. tuberosa* mixture compared with that of a perennial ryegrass mixture under exactly the same conditions. The soil type was Takapau silt loam, a medium to light silt loam basically deficient in phosphate and calcium and subject to fairly severe summer drought.

The *P. tuberosa* was sown at 7 lb per acre and the perennial ryegrass at 30 lb per acre in autumn 1951. By autumn 1953, when pasture production measurements were started, subterranean clover had volunteered into both areas, and perennial ryegrass had volunteered into the *P. tuberosa* area.

As the two areas were in the same paddock, the *P. tuberosa* was a little too heavily grazed in the first and possibly even the second year, since the ryegrass needed control grazing. The graph shows the seasonal production of dry matter of herbage over three years with the production of *P. tuberosa* and perennial ryegrass in each mixture. The total yield from the perennial ryegrass mixture was 15,060 lb dry matter per acre, the actual yield of perennial ryegrass

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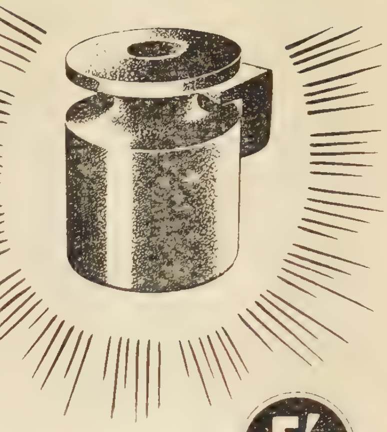

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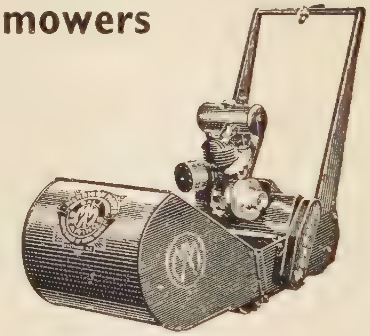

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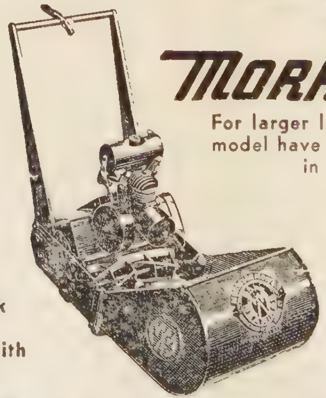

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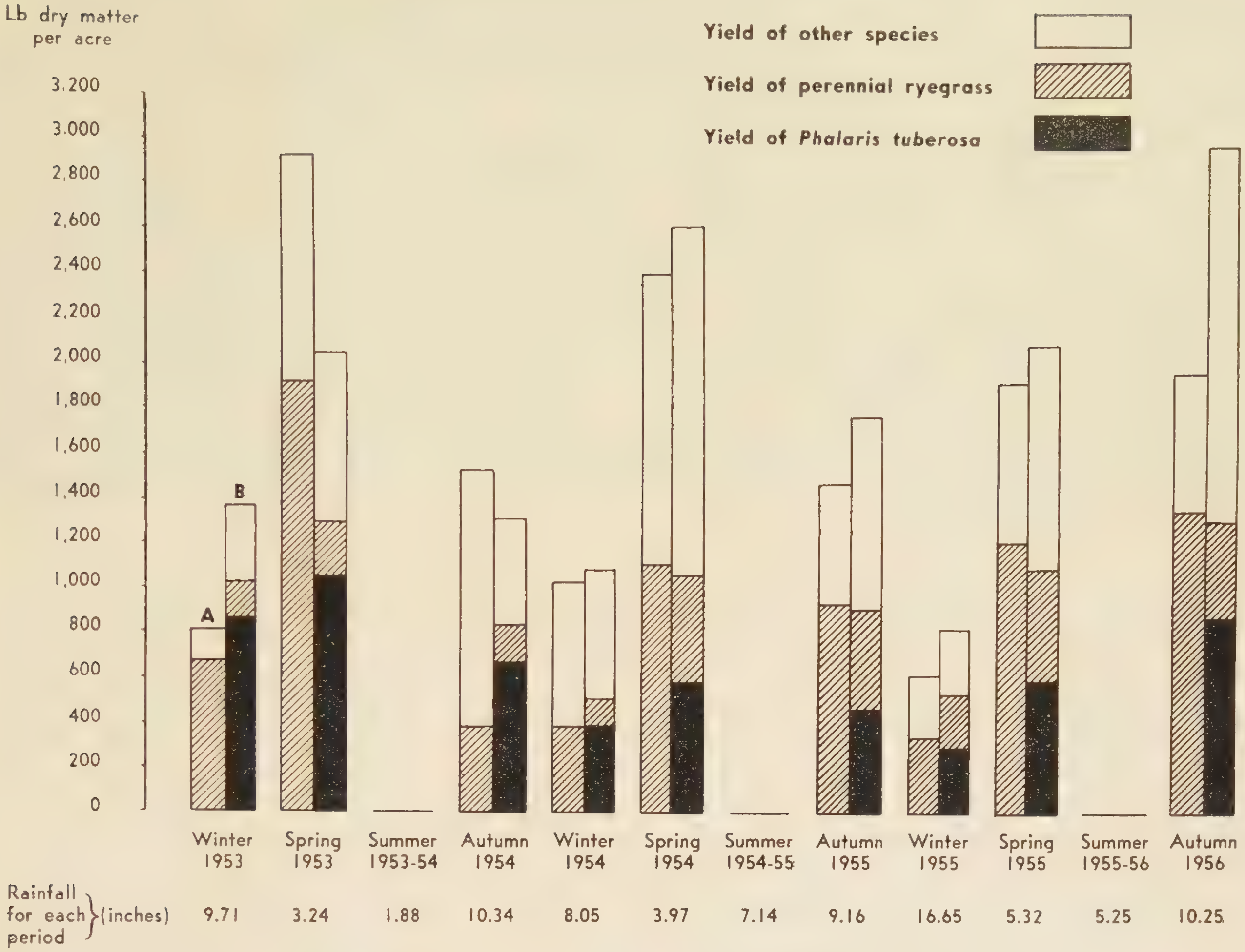

Results from a rate of growth trial comparing production from a perennial ryegrass mixture (A) with that from a *P. tuberosa* mixture (B).

being 8,350 lb of dry matter per acre. For the *P. tuberosa* mixture the total yield was 16,400 lb of dry matter per acre, the *P. tuberosa* contributing 5,810 lb of dry matter per acre to this total.

The summer rainfall for 1953-54 was normal, and *P. tuberosa*, with fewer plants per acre than ryegrass, produced markedly more feed than ryegrass during the ensuing autumn of 1954. However, the total yield was still greater on the ryegrass area owing to the better growth of volunteer subterranean clover at this stage. By spring 1954 perennial ryegrass was a major species in the *P. tuberosa* area, and from then on this mixture of *P. tuberosa* and ryegrass outyielded the ryegrass area in all seasons.

The *P. tuberosa*, subterranean clover, perennial ryegrass, and other volunteer species have carried the total yields to 1,380 lb of dry matter in excess of the ryegrass and subterranean clover area over the three years. This means an increase of about 4 cwt of dry matter or about 1 ton extra of green grass produced per acre annually.

This, even under seasonal conditions generally more favourable for ryegrass than is usual, represents a substantial increase when converted to terms of higher carrying capacities. It is especially important where many farmers allow their stock numbers to be governed mainly by the minimum grass growth period of the year rather than cater for those periods with supplementary crops, hay, and silage.

It is not recommended that *P. tuberosa* and subterranean clover should be the sole constituents of these light land pastures, as perennial ryegrass has an important place in the sward in late-winter to mid-summer production, and throughout the year when seasons are favourable. However, as ryegrass volunteers quite satisfactorily into the average *P. tuberosa* area, and as *P. tuberosa* never establishes well when sown with perennial ryegrass and managed accordingly, it is not advisable to sow the ryegrass with it. If perennial ryegrass does not volunteer into the sward satisfactorily, it can be introduced with subterranean clover, and cocksfoot if necessary in the second or third autumn by the use of a sod-seeder or by overdrilling.

Subterranean clover sheds several hundredweights of seed per acre where it is dominant on light land pastures, and much of this seed remains viable in the soil for several years, so that on land which has had this clover in reasonable proportion in previous pastures it will volunteer sufficiently to obviate the necessity of seed being sown.

Seeding Rate

For this combined sward 4 to 5 lb of *P. tuberosa* should be sown. To ensure freedom from *Phalaris minor*, certified seed of New Zealand or Australian origin should be used. The purity and germination of the line should be judged from a recent certificate.

Where the sowing of subterranean clover seed is necessary equal proportions of certified Mt. Barker and Tallarook strains should be sown.

Seed mixture

		Lb
Certified *P. tuberosa*		4–5
Certified cocksfoot		5
Crested dogstail	Only where they have not been growing previously	1
Subterranean clover		2

This mixture may be broadcast or drilled carefully with the Blackmore coulters on a well prepared seedbed to ensure full paddock coverage.

Establishment

The seedbed should be reasonably fine in texture and, most important of all, well consolidated with two or three rollings.

The area should receive at least 2 cwt per acre of superphosphate before sowing, or reverted superphosphate on sowing down.

Dieldrin or DDT superphosphate should be used where the land is at all subject to grass grub infestation, since grass grub will infest crop, grass, and even fallow paddocks in the late summer, eating the roots of any young plants growing there during the ensuing autumn.

After the seed has been sown, preferably about the time of the first autumn rains, it should be very lightly covered by brush or light grass harrows so that most of the seed lies ¼ to ½ in. under the soil surface. The paddock should then be shut for eight to 10 weeks and possibly longer, depending on weather at the time.

When the *P. tuberosa* has reached a height of about 3 to 4 in. it can be grazed down to about 1 in. again, in as short a time as possible, a large mob of sheep being used for quick grazing. The paddock should then be spelled as previously until the grass is about 3 to 4 in. long again, when the same grazing technique should be used.

This policy should continue right through the first year until the end of the following autumn, when the *P. tuberosa* will be well established with a good rooting system, so that hard grazing will not affect the plants unduly.

Since *P. tuberosa* is a relatively high-fertility-demanding species, topdressings of phosphate and lime should be applied during the ensuing years on country where deficiencies indicate they are needed.

Toxicity of Pure *P. tuberosa* Stands

Both in New Zealand and Australia, where sheep have been left to graze fairly pure stands of *P. tuberosa*, ataxia or "phalaris staggers" has occurred and caused stock losses.

Meteorological Records for April

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	240	61.0	— 0.1	76.8	42.3	8.01	18	+ 2.41	2.65	5	153
Auckland	160	61.4	+ 0.1	73.1	47.8	8.95	13	+ 4.56	3.44	8	183
Tauranga	12	58.8	+ 0.3	72.0	36.6	10.49	11	+ 5.47	4.32	9	200
Ruakura	131	56.6	+ 0.0	73.9	32.9	7.91	16	+ 4.17	2.72	5	182
Whakarewarewa ..	1,006	54.8	— 0.2	68.8	30.9	10.52	12	+ 5.71	5.17	8	165
Gisborne	14	57.9	+ 0.0	76.4	35.7	1.74	14	— 1.92	0.40	13	141
New Plymouth ..	160	58.4	+ 1.0	70.1	42.2	6.59	16	+ 1.68	2.07	11	179
Karioi	2,125	50.4	+ 0.0	71.0	26.6	2.85	13	— 0.97	0.62	6	
Napier	5	57.2	— 1.3	76.0	33.8	1.42	10	— 1.21	0.45	9	166
Wanganui	72	57.0	— 0.5	72.4	39.4	3.25	13	+ 0.45	0.82	6	164
Palmerston North ..	110	55.2	— 1.4	76.2	32.0	3.63	13	+ 0.27	1.38	6	138
Waingawa	340	54.4	— 0.1	75.7	31.0	1.99	16	— 0.91	0.66	6	156
Wellington	415	57.1	+ 1.0	73.3	41.1	2.59	9	— 1.22	0.90	11	150
Nelson airfield ..	5	54.5	+ 0.4	67.3	31.2	4.48	10	+ 1.53	1.35	8	198
Blenheim	12	55.8	+ 0.3	76.3	30.3	1.79	8	— 0.25	1.21	9	208
Hokitika	15	54.4	+ 1.5	67.5	32.2	7.57	15	— 1.26	2.13	11	158
Hanmer	1,270	51.8	+ 0.3	76.5	25.6	6.19	12	+ 2.85	1.92	27	161
Christchurch ..	22	55.3	+ 1.8	76.8	31.9	3.13	7	+ 1.28	0.90	12	166
Ashburton	323	55.6	+ 3.0	80.6	30.8	1.00	7	— 1.41	0.35	12	159
Timaru	56	55.0	+ 2.0	73.6	31.9	0.93	7	— 0.73	0.59	10	165
Alexandra	520	52.8	+ 1.7	76.2	33.3	1.16	9	— 0.19	0.60	11	151
Taieri	80	52.4	+ 1.1	76.4	34.0	3.57	11	+ 1.47	0.99	17	104
Invercargill airfield ..	0	51.6	+ 1.7	69.6	29.3	4.72	15	+ 1.00	1.35	27	93
Chatham Islands ..	150	54.4	+ 1.3	68.2	41.9	1.96	18	— 0.61	0.34	27	

It appears necessary to have sheep grazing on almost pure stands for several weeks for ataxia to break out, and in all reported cases, both in New Zealand and Australia, the ill health has been prevented by a prior application of cobalt. Country tending to be deficient in cobalt should receive cobaltised superphosphate both on sowing down and as after treatment. Pure or near-pure *P. tuberosa* stands should receive cobalt even if the land is not known to be cobalt deficient, as excess cobalt is not injurious to plant or stock health.

As a precaution against ill health sheep should not be left grazing a pure stand for too long at one period.

In a mixed sward, including *P. tuberosa*, cocksfoot, either sown or volunteer crested dogstail, subterranean clover, and ryegrass, such ataxia outbreaks are extremely unlikely.

Overdrilling

To date no experimental work on the suitability of *P. tuberosa* for overdrilling into already established pasture has been done in this district. However, though the method appears to be most suitable for gaining a well combined sward, it is thought that it would be satisfactory only on the already recommended light land areas and only where the farmer is prepared to work along the following lines:

1. Hard graze the paddock right down.
2. Apply up to 5 lb of dalapon per acre to retard ryegrass and clover growth for quite a considerable period so that they will not compete with the slowly establishing *P. tuberosa*.
3. Be prepared to lose most of the production off that paddock during the first five to six months.

Role in Hawke's Bay

From work done in Hawke's Bay, particularly on light land, it is apparent that *P. tuberosa* has a definite place in the farming economy of the province. When the plant is established its deeper rooting system greatly offsets the effects of seasonal droughts that are frequently experienced, and under such conditions its production can be much higher than that of the usual ryegrass-white clover swards. It also gives good winter production.

It is not well suited to the heavier soils, where English grasses and clovers will outyield it. Cost of establishment is somewhat lower than that for a dominantly ryegrass sward, and provided it is suitably topdressed, an area can be a useful adjunct to other pastures on any Hawke's Bay farm on the lighter soil types.

▲ Roadside group dosing of dogs in the Waikato at a site prepared by the Piako County Council. Dog purgings, other than material taken for sampling, are buried and disinfection is carried out.

Progress in Eradicating Hydatids in N.Z.

By A. D. M. G. LAING,
Superintendent of Hydatid Control, Department of Agriculture, Wellington

PROGRESS in the control of hydatid disease since eradication groups began to be organised with the assistance of setting-up grants from the Department of Agriculture in 1957 is reviewed in this article. Voluntary efforts of farmer groups, the cooperation of local bodies, the setting up of regional councils or committees, the creation of a National Hydatids Committee, and the establishment of the Hydatid Research Unit of the Medical Research Council have led to such intensive development of the control and eradication campaign that infection potential for both humans and farm animals must already have been greatly reduced.

A VERY small tapeworm which lives in the small intestine of dogs is the cause of hydatid disease. Worm infestations in a dog can be as high as 20,000. The eggs, of which 500 to 800 are produced every fourth or fifth day, are expelled in the dog's faeces and when the faeces disintegrate the tiny eggs lie on pasture and in sheep yards or blow about.

If swallowed by sheep, cattle, or other farm stock or human beings, the hydatid eggs develop into large cysts or bladders full of liquid. These occur mainly in the liver or lungs, but also in the brain and other organs. The liquid in the cysts contains large numbers of minute tapeworms and if it is eaten by a dog, the tapeworms in it develop into the hydatid tapeworm.

Heavy Losses

The substantial losses caused by the parasite have been due to the condemnation at slaughter of meat by-products, mainly livers and lungs; indirectly to loss of reputation of meat products in overseas markets; and last, but most important, the high incidence of hydatid disease in humans.

The principal cause of the losses has been cysts of *Echinococcus granulosus*, the tiny tapeworm already described, of the dog, which passes its larval stage as a cyst in the organs, mainly the liver and lungs, of farm animals and humans. Less important, but still causing substantial loss, has been a canine tapeworm of the same zoological family (and with a life history somewhat similar to that of the hydatid worm), namely *Taenia hydatigena*.

The normal cystic stage of this worm, however, is relatively harmless,

Hydatids—An Anomaly in New Zealand

NEW ZEALAND has a fine record of social and agricultural efficiency and progress. It is quite anomalous, therefore, that it should also have a relatively high incidence of hydatid disease in both man and farm animals.

However, by the enterprise, initiative, and keenness of progressive farmers throughout the country an excellent and most promising start has been made in the difficult task of eliminating hydatid disease in New Zealand.

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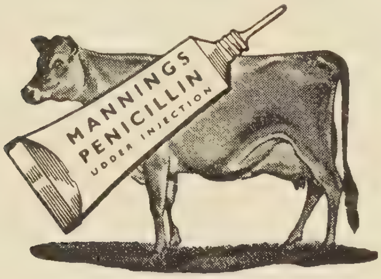
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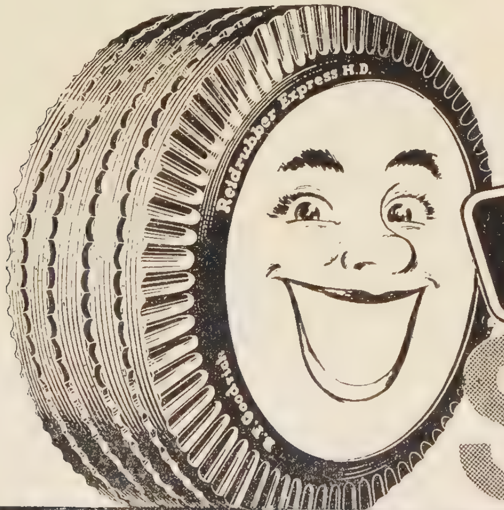
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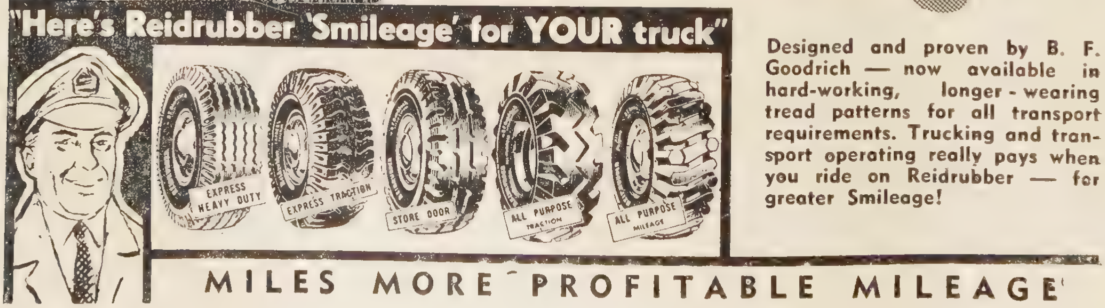
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being a "jelly-bag" like cyst (the *tenuicollis* cyst) which adheres to the walls of the abdominal cavity or the external surface of the bowels. The embryos from the eggs of this tapeworm passed by dogs, in their passage through the liver to the normal site described above, may cause tissue damage. Many livers of lambs on slaughter have been found to be damaged in this way and have been either condemned or judged unexportable.

The losses described have occurred because dogs have been infected through feeding on offals containing hydatid and other worm cysts. This has most frequently come about when sheep are slaughtered for food or for "dog-tucker" on farms. To a less extent dogs have been infected through eating carcasses of animals dying on the farm.

Though a small number of farmers, by applying the measures outlined later, had succeeded in varying degrees in controlling hydatids in their stock, the farmers of New Zealand as a body realised the true seriousness of the position, both of hydatid disease in humans and of losses of meat by-products, only in 1957.

Eradication Groups

In 1957 hydatid eradication groups on a national scale began to be organised by farmers.

These local hydatid eradication schemes are on a **geographical community basis;** for example, a valley, a road, or a community hall. Committees comprise a representative from each sub-group of 10 to 20 or more farms. Committee members visit farms in their sub-groups and advise on and assist in the measures carried out.

A £50 setting-up grant is available from the Department of Agriculture to all such committees, provided they are certified as functioning efficiently by the local Livestock Instructor of the Department and there is a minimum of 50 farms.

A central council or committee is formed from these local committees. This organisation has sometimes built up from the sub-group level, or provincial branches and local branches of Federated Farmers and county councils have called meetings and divided the county into group areas as described and the local sub-groups have built up accordingly. But in either case the local sub-committee representing all dog owners in its area is essential.

Control Methods

The control methods being used for hydatid eradication are based on breaking the life cycles of the hydatid and other tapeworms between the primary host, the dog, and the secondary host, the farm animal.

The principal measures include ensuring that dogs are not fed raw offal; if offal is fed, it should first be boiled for half an hour. Offals include the entire contents of the chest and abdominal cavities. Offals not boiled for dog food are burnt or buried deeply.

DOG WEEK 1ST-8TH FEB.
HYDATIDS
YOU ARE NOW IN
A CONTROLLED AREA
WE DOSE OUR DOGS
DO YOU ?

This roadside notice in Hawke's Bay is typical of the action taken by farmers' voluntary hydatid eradication committees.

Group members control their dogs at all times and prevent their eating carcasses lying on the farm. Many local bodies assist by using their powers under the Dogs Registration Act 1955 to deal with stray dogs. The dogs are purged with arecoline hydrobromide every three months to remove tapeworms.

Many county councils and other local bodies have cooperated closely and have voluntarily assisted in local schemes by clerical and administrative help, use of machinery at cost to prepare roadside sites for group dosing, and use of post-hole diggers to dig deep holes for the convenient disposal of offals.

In the Bay of Islands County, where the Hydatid Research Unit of the Medical Research Council has carried out field research, the incidence of true hydatid tapeworms in dogs has fallen to 1 in 700, and of *Taenia hydatigena*, the cause of *tenuicollis* cysts, to 1 in 500 dogs. A full-time trained technician has been employed, as described later, for about a year, expenses being met by voluntary payments by owners of the 2,300 dogs in the county.

A recent development is the formation of a National Hydatids Committee representative of all interests concerned with hydatid eradication, including the Departments of Agriculture and Health.

Local bodies are now empowered to raise finance for hydatid eradication by a levy on dog owners of up to £1 per dog per year, with a maximum of £5 per owner. A number of local bodies are taking advantage of this and intend to employ full-time hydatid control officers on the same lines as in the Bay of Islands County.

Plans are in hand for the training of these officers. Their work will include recording all dogs in their areas, purging dogs periodically and collecting samples for laboratory examination, and assisting dog owners in all aspects of hydatid eradication, including offal disposal and the feeding and housing of dogs.

The organisation of diagnostic facilities for determining the presence of tapeworms in faecal samples from purged dogs is another need which is being met so that a check can be made for breakdowns in eradication methods. Faecal samples will be taken and examined at the quarterly dosings of dogs and if hydatid or other tapeworms are found, the cause will be investigated to enable the breakdown to be remedied.

Voluntary control groups have applied hydatid eradication methods on a scale and with an efficiency which must already have reduced greatly the hydatid disease infection potential for humans and for farm animals.

Educationally, public opinion has now in most areas reached a point at which the person who deliberately feeds raw offal to his dogs or allows them to feed on it, and thus make them carriers of hydatid disease, is regarded as a bad neighbour.

On the research side, the Hydatid Research Unit of the Medical Research Council is organised and functioning to deal with present problems and any which may occur in the future.

Finally there is a national organisation in being, the National Hydatids Committee, to lead and coordinate those engaged in eradicating hydatid disease.

Care of Livestock during July

Contributed by the Animal Research Division

MILKING METHODS ARE IMPORTANT

AT the start of a new season cows should be trained to let down their milk quickly and competely by the establishment of a fixed milking routine in which they are brought into the shed, bailed up, washed, and milked in the same way at each milking. Anything which upsets the cows must be avoided. A brief but vigorous wash followed by the withdrawal of a squirt of milk from each quarter into a strip cup is the best method of stimulating the flow of milk. This will also help in detecting cases of mastitis early.

As the duration of let-down is limited, cups should be put on immediately after the washing and starting process. A good milk flow indicator should be used and as soon as this shows that milk flow is slowed to ½ lb per minute the cups should be pulled down until milk flow again falls to this rate, when they should be removed at once. Massaging of the udder while the cups are pulled down should be practised only with cows which are known to need it.

PULPY KIDNEY IN LAMBS

Where pulpy kidney occurs in lambs under six weeks of age its incidence can be reduced by vaccinating the ewes before lambing. If ewes have never been vaccinated before, best results will be obtained from two doses of vaccine given at least a month apart. Ewes which were vaccinated last year will require only one vaccination.

The last (or the only) vaccination should be given about a fortnight before lambing and this can be done quite safely if ewes are handled carefully. Very poor immunity results where the ewes are vaccinated much earlier. If most losses from pulpy kidney occur in lambs over six weeks of age, vaccination of ewes is of no value, but vaccination of lambs at marking with a second dose later may help.

BLOOD POISONING IN EWES AND LAMBS

Losses from blood poisoning in lambing ewes and marked lambs can be greatly reduced, if not eliminated, by vaccinating the ewes with blackleg vaccine about a fortnight before lambing. As the immunity which passes from the ewe to the lamb in the first milk does not persist for many weeks, lambs should be marked early. To obtain the best results, it may be necessary to divide the ewes into early and late lambers, which should be vaccinated separately before lambing.

Advice on vaccination can be obtained from any office of the Department of Agriculture. Where possible ewes should lamb in clean spelled paddocks, and lambs should always be marked in clean temporary yards. Sometimes losses from blood poisoning occur in lambing ewes that have not been vaccinated. If losses are occurring, it is too late to vaccinate. It may be possible to save ewes by treating them with penicillin if the penicillin is used early enough.

It is important that blood poisoning be confirmed, and the local veterinarian should be consulted in this matter. After such confirmation all ewes which are assisted in lambing should be treated by penicillin injection. This should be an emergency measure and should not replace vaccination, which is the cheapest and most certain means of treating blood poisoning.

CONTROL OF HYDATIDS

The greatest mortality of mature sheep occurs during lambing time. These animals are most likely to be infested with hydatid cysts, and special care is therefore needed to see that dogs are controlled so that they will not have access to dead sheep in the field. Carcasses should be destroyed as quickly as possible.

SLEEPY SICKNESS IN EWES

Heavy losses from sleepy sickness sometimes occur in ewes carrying twins or heavy single lambs. These losses may be prevented by ensuring that ewes do not suffer a check just before lambing. If necessary, they should be divided into early and late lambers and drafted on to the best feed available three to four weeks before lambing. Research has shown that poor feed for five weeks before lambing can reduce the fleece weight by more than ½ lb.

RINGWORM IN CALVES

Ringworm in calves is sometimes troublesome, especially in poorly nourished calves. Before any remedy is applied the scales should be removed by rubbing in a mixture of equal parts of soft soap and lard and scraping off the softened scabs the next day. The bare patches should then be dressed with an ointment of 1 part of calicylic acid and 8 parts of lard or with any registered stock remedy for ringworm which is available.

As the infection can be transmitted to man, it is wise to wear rubber gloves when treating ringworm. In any case the hands and arms should be thoroughly washed immediately after the dressings are applied.

ERGOTISM IN CATTLE

Hay made from ergotised grass will cause lameness and sometimes even loss of feet in cattle. The small black ergots which replace the seeds of ryegrass and other grasses can be easily seen, and if they are present in large numbers, the hay should not be used. Similar trouble often occurs when cattle are grazed on tall fescue grass even when no ergots are present. This grass should be regarded as poisonous and should not be grazed by cattle.

WINTER FEEDING OF COWS

It is imperative that cows should be well fed for six to eight weeks after calving. They should have access to hay at all times, and if the pasture is poor, they should also receive up to 20 lb of silage per day. Early-calving cows should be given about two hours' grazing per day on autumn-saved pasture and in addition should be fed as much silage as they will eat.

Farm Maintenance Work and Subdivision

Seasonal Notes by the Extension Division

MAINTENANCE OF IRRIGATION DITCHES

THOROUGH cleaning of the usual 8-cusec ditch is beyond the capacity of normal farm equipment, but contractors with suitable plant are available to do this work at reasonable cost. Where silting is a problem a silt trap, made by widening about a chain of the existing ditch just below the turn-out, is advisable.

Ditches passing through paddocks intended for crop or hay need special treatment. They may be temporarily fenced and grazed during summer or treated with chemicals such as dalapon at 10 lb per acre and amitrol at 5 lb per acre. This material applied at this rate (about 5 to 6 oz per chain) in late autumn and early winter gives satisfactory control of growth during the following summer. Treatment of headgate surroundings in this way is also worth while. It gives water a free passage on to the paddock and wastage over banks and through headgates is reduced.

Faulty junction boxes are a common source of losses, which though small individually, may amount to 1 cusec or more. Boxes known to leak below the footing should be dug out and the blocks reset deeply in concrete.

Culverts should be inspected for accumulations of shingle and other debris. Culvert inlets should be cleared of weed growth, because even minor obstructions here may seriously reduce the flow that can be carried.

Older ditches may have deteriorated to such an extent that the best way of dealing with them is to fill them in and cut a new ditch. This may be most conveniently done while the paddock is under the plough.

—B. A. LAUDER, Ashburton

* * *

SUBDIVISION OF DAIRY FARMS

MORE efficient pasture utilisation and subsequently more production have been obtained on many dairy farms by intensive subdivision. The subdivisions should be big enough to graze 20 to 30 cows per acre for a 24-hour period over spring.

During spring the normal paddock-by-paddock rotation should be completed in about 21 days. This means that a few paddocks would not be grazed in one particular cycle, and therefore would "shut themselves up" for silage and hay.

A layout with paddocks beside a race is the easiest and best to work. The race should be well crowned and have good drainage on either side. Race widths vary, but about 15 ft is the most popular, with gateways offset for easy access to paddocks.

Interior subdivisions of paddocks can be erected cheaply, a single electrified wire being used, plain or barbed, supported on stakes at two or three per chain.

Close subdivision has its limitations on wet, heavy land subject to poaching, but on most of the drier and better drained dairy land it can result in increases in production.

—D. L. JANETT, Pukekohe

* * *

Various chemicals can be used for the control of weeds in irrigation headraces. The illustration shows the result of using monuron at 40 lb per acre. An untreated section of the headrace is in the background.

OVERHAULING FARM MOWERS

BEFORE a mower is checked and aligned all worn parts should be replaced. The mower should then be set up as for work, with the hitch at the correct height and the tilt of the finger bar in the mid-position. Once this has been done the machine can be readjusted ready for the next season.

When the machine is adjusted correctly the pitman should lie at right angles to the crankshaft, and the outside end of the knife should have a lead of ¼ in. for every foot of cut. This allows the knife to run in a straight line with the pitman when under load.

To check the lead, first press the cutter back to take up any movement and then stretch a string from the centre of the bearing where the pitman joins the crankshaft along the line of the pitman to the far end of the cutter bar. The lead can be adjusted by altering the length of the stays or draglink or by turning a sleeve fitted in the stirrup holding the cutter bar.

The knife should fit snugly along its entire length. This means that the fingers must be lined up so that the knife sections lie flat on the faced surface of the finger. Lining up the fingers can be done with a string or by sighting, and those out of line tapped up or down with a hammer. Also, if there is any play in the knife where it passes under the clips, these can be either tapped down if they are malleable castings or adjusted by removing shims. However, care should be taken when this is done to see that the knife runs freely.

When the knife is set correctly every section should be exactly at the centre of a finger when the pitman is at the extreme inner or outer end of its stroke.

—R. G. BURTON, Palmerston North

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Citrus Orchard Nutrition and Soil Management

By W. A. FLETCHER,

Citriculturist, Department of Agriculture, Auckland

CITRUS trees, like most green plants, require at least 15 chemical elements for growth. Carbon obtained from carbon dioxide in the atmosphere and hydrogen and oxygen from water are combined in the green leaf by the process of photosynthesis to build simple organic materials such as sugars which with mineral substances taken up in solution from the soil are eventually elaborated by the tree into all the complex organic materials that enter into its structure and functioning. The mineral elements necessary from the soil are nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur, known as major elements; and iron, manganese, boron, copper, zinc, and molybdenum, referred to as minor, trace, or micro-nutrient elements. The trace elements are just as essential for growth as the major elements, but are so named because they are necessary in only minute amounts compared with the major elements.

THE first section of this article, which will be concluded in next month's issue, deals with the major soil elements, and the second section will discuss the minor elements, the use of mixed fertilisers, the use of lime, and the role of organic matter in the maintenance of soil fertility.

SOME soils are naturally more fertile than others, but in New Zealand, citrus orchard soils, with the exception of those on the fertile Gisborne plains, are generally low in available plant nutrients, and fertilisers must be used to supplement the soils.

Fertiliser requirements for citrus orchards cannot be simply determined. Unfortunately soil analyses are of limited value, as no ideally suitable chemical means of measuring the ability of roots to absorb plant nutrients has been devised. Moreover soils vary so much that it is very difficult to obtain a soil sample truly representative of the zone exploited by the tree roots. Soil analyses can be helpful, however, to ascertain the acidity or alkalinity of the soil (expressed as pH) and its lime requirement and potassium tests may also be helpful.

Leaf analysis shows some promise of indicating nutrient deficiencies in the citrus tree, but facilities in New Zealand are at present available only for research work. It is now known that deficiency or excess of nutrients is associated with distinctive growth symptoms on citrus trees and these symptoms can be very helpful in judging fertiliser requirements. Interpretation of symptoms in the field can be complicated, however, by multiple deficiencies and effects due to pests and disease, sprays, climatic factors, and mechanical injuries.

Evidence in New Zealand indicates a need in most citrus orchards to apply nitrogen, phosphorus, and potassium, but in Gisborne orchards phosphorus and especially potassium are probably unnecessary. Magnesium and manganese are also commonly deficient in all districts and zinc deficiency has been recorded at Kerikeri, but generally its effects have not been serious.

Calcium in the form of lime is necessary in many orchards to reduce soil acidity. There is no definite evidence that any of the other elements essential for growth such as sulphur, iron, copper, boron, or molybdenum are deficient in citrus orchards in this country or that applications of these nutrients will materially improve growth, yields, or fruit quality.

Fertiliser recommendations cannot be made which will satisfy all citrus growers, but the following discussion on the influences of individual nutrients and their requirements by citrus trees in New Zealand should provide a guide for growers in handling problems of plant nutrition on their orchards.

NITROGEN

Proteins, chlorophyll, and other compounds in the plant all contain nitrogen and this nutrient has a pronounced influence on the growth, amount of blossom, and yields of citrus trees. It also assists the tree to take up magnesium and calcium and tends to decrease the uptake of phosphorus, potassium, zinc, and copper.

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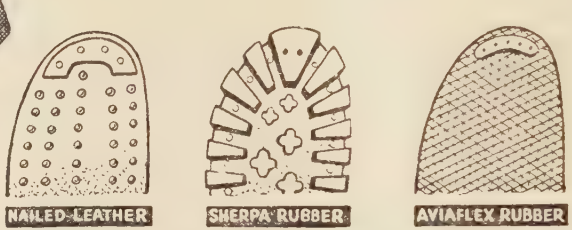

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Effects of Deficiency and Excess

Severe nitrogen starvation results in yellowish, sparse foliage and stunted growth, but trees grown with limited supplies of nitrogen may appear nearly normal except that they are undersized, make limited growth, and produce few blossoms or fruits. Leaves usually also lack the dark green and lustre of those found on trees adequately supplied with nitrogen.

Excessive supplies of nitrogen not only promote extra vigorous growth, but may induce a phosphorus deficiency and cause fruits to be coarse, thick skinned, and later in maturing. This effect has been observed with New Zealand grapefruit trees after heavy dressings of nitrogen fertilisers, especially when applied in late summer or autumn. It has been shown in Florida, however, that excessive potassium supply has considerably more adverse effect on orange quality than the nitrogen supply.

Amounts to Apply

It has been the practice in California to apply 200 to 300 lb of nitrogen per acre each year, but recent research suggests that these rates may be excessive and that 100 to 150 lb are sufficient for maximum yields.

In Australia it has also been shown that worthwhile increases in growth and yield are not obtained by applying more than about 150 lb of nitrogen per acre per year.

There have been no experiments in New Zealand to determine optimum rates for applying nitrogen fertilisers to citrus trees, but it seems reasonable that rates should be at least equivalent to those used in Australia and California. As spring and summer temperatures in New Zealand citrus areas are cooler than those in Australia and California and are marginal for citrus growing, growth and yields may benefit from higher rates of nitrogen in this country. Moreover in New Zealand's high-rainfall climate much nitrogen is probably lost from leaching and run-off and a higher rate of nitrogen application may be beneficial to help compensate for this.

It is recommended that 150 to 200 lb of nitrogen per acre be applied to bearing citrus orchards in New Zealand. The rates per tree will, of course, vary according to the numbers of trees planted per acre. For example, for orange trees spaced at 18 ft x 15 ft, that is 160 trees to the acre, the rate of nitrogen would be about 1 to 1½ lb per tree, but with larger lemon and grapefruit trees planted at 80 to 90 trees per acre the rate would be 2 to 2½ lb per tree.

Citrus orchard soils in New Zealand, with the exception of those on the fertile Gisborne plains, are generally low in available plant nutrients, and good production of quality fruit as in this well maintained grapefruit orchard can be achieved only by attention to adequate and balanced manurial practices.

Some growers in the Bay of Plenty are applying 3 lb of nitrogen to their lemon trees per year and are apparently well satisfied with results. Poor growth and yields are frequently observed in this country with orange trees, which have a higher heat requirement for optimum growth and yields than lemons or New Zealand grapefruit, and beneficial results with these fruits are likely from heavier nitrogen fertiliser applications along the lines indicated above.

Trees on the slow-growing trifoliata rootstock are especially likely to benefit from heavier applications of nitrogen, whereas requirements of trees on sweet orange and rough lemon rootstock may be less.

Citrus trees in all the citrus districts are likely to benefit from nitrogen applications, but requirements on the fertile Gisborne plains are probably much less than those at Kerikeri, Bay of Plenty, and Auckland. Heavier dressings of nitrogen are necessary on heavier clay soils than on sandy soils to obtain comparable responses.

Sources of Nitrogen

Nitrogen for use as a plant food may be obtained from bulky organic materials such as vegetable matter and animal manures and from more concentrated commercial fertilisers of organic and chemical origin.

The percentage of nitrogen in bulky organic matter is low and varies from considerably less than ½ per cent in some vegetable material to more than 3 per cent in other materials such as lucerne hay and high-grade poultry manure. It also provides other nutrients, including phosphorus and potassium, and the organic matter is of value for improving the physical condition of the soil and increasing its humus content. Nevertheless supplies of bulky organic matter are not readily available to the average orchardist and transport costs tend to make them too expensive compared with other fertilisers. It requires a dressing of about 9 tons per acre of an animal manure or other bulky organic matter containing ½ per cent of nitrogen to supply 100 lb of nitrogen per acre.

Poultry manure or other material containing about 1½ per cent nitrogen should be applied at about 3¼ tons per acre to provide 100 lb of nitrogen per acre. If only limited supplies of bulky organics are available, maximum benefit is obtained by making heavy dressings round the trees on a roster system rather than by spreading light dressings over the whole orchard.

More concentrated forms of organic fertilisers such as dried blood (12 per cent to 13 per cent nitrogen), blood and bone (7 per cent nitrogen and 10.6 per cent phosphoric acid (P_2O_5)) and fish manure (6 per cent nitrogen and 12½ per cent phosphoric acid) are excellent fertilisers, but the cost per unit of nutrients is high. The amounts of organic matter they supply are negligible. To apply 1 lb of nitrogen requires 8 lb of dried blood, 14 lb of blood and bone, and 16 lb of fish manure.

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VH11.8

Chemicals are the most economical source of nitrogen. Those commonly used today are sulphate of ammonia (20½ per cent nitrogen), calcium ammonium nitrate (20½ per cent nitrogen), nitrate of soda (16 per cent nitrogen), and urea (44 per cent to 46 per cent nitrogen). Rates at which these fertilisers must be used to apply 1 lb of nitrogen are 5 lb of sulphate of ammonia or calcium ammonium nitrate, 6 lb of nitrate of soda, and 2¼ lb of urea.

The form of nitrogen applied appears to be much less important than the amount available to the tree and there is no evidence to show any superiority of organic nitrogen over inorganic nitrogen in performance. Provided ample use is made of cover crops or volunteer growth to supply organic matter to the soil and to maintain it in good physical condition, chemical forms of nitrogen can be used exclusively with considerable savings in cost.

Nitrogen in organic matter is insoluble in water and is only slowly available. It must first be broken down by soil organisms into ammonium compounds and then nitrified by bacteria into soluble nitrates, which are the normal nitrogenous food of plants. Commercial organic fertilisers such as dried blood, blood and bone, and fish manure break down more readily in the soil and act more quickly than bulky organic fertilisers.

Chemical nitrogenous fertilisers are all soluble in water and quick acting.

Sulphate of ammonia is the most common fertiliser in this group. It is a very good source of nitrogen, which is all contained in the ammonium form. The ammonium portion of the chemical is absorbed by soil colloids and is slowly released as nitrifying bacteria convert it to nitrates.

This temporary fixation of sulphate of ammonia in the soil is very important in minimising losses from leaching in our high-rainfall climate. Within about a month most of the ammonium nitrogen is changed to nitrates and is available to the trees. Sulphate of ammonia causes most soils to become acid, but this can be avoided by adequate liming. Usually about 1½ cwt of carbonate of lime is required to correct the effect of 1 cwt of sulphate of ammonia.

Urea acts very much like sulphate of ammonia when applied to the soil, except that its initial penetration is greater. Urea can also be applied as foliar sprays (7½ lb of urea to 100 gallons), but the desirability and effectiveness of this practice need more study. Best results are likely from sprays in spring before blossoming.

Nitrate fertilisers such as **calcium ammonium nitrate** and **nitrate of soda** do not need nitrifying and are very quick acting. Their nitrogen is available immediately it is dissolved in the soil moisture. Nitrate fertilisers have often given disappointing results on light, free-draining soils in the Bay of Plenty, probably because of excessive leaching of the fertiliser before it can be used by the trees.

To overcome this, these fertilisers should be applied in several small dressings rather than in a single larger dressing. Nitrate nitrogen may have particular merit for use in orchards in permanent sward when the soil nitrogen may be locked up in plants and soil organisms and not available for the trees during blossoming.

Nitrate fertilisers may also be more effective on heavier clay soils round Auckland during cool spring weather. However, continuous use of nitrate of soda on clay soils may be harmful to soil structure and use of calcium ammonium nitrates is preferable.

Timing Applications of Nitrogen

Recent work in California has shown that applying nitrogen to orange trees in summer and autumn when compared with spring applications tends to result in coarser, poorer coloured fruit and there is reason to believe that this tendency exists with orange and grapefruit trees in New Zealand. On the other hand, studies in Florida have failed to show consistent differences in either yield or fruit quality of several varieties of orange from applying nitrogen in one to six applications a year and in one application at different seasons of the year.

It is recommended that orange, mandarin, and grapefruit trees in New Zealand should receive the greater part of their nitrogen requirement in August. To stimulate the autumn flush of growth, small dressings of nitrogen amounting to no more than about a third of the total amount required can be applied in February.

Lemon trees may benefit from receiving their nitrogen in three equal dressings applied in August, November, and February. Heavy nitrogen dressings in spring may stimulate a heavy main crop setting of lemons at the expense of later settings which produce the valuable summer crop.

PHOSPHORUS

Phosphorus is important for the building up of nucleo-proteins in the plant and is found abundantly in the young, growing parts. It is thus closely concerned with all growth functions, but root activity is especially stimulated. Applying phosphorus also tends to counteract effects of excess nitrogen.

Effects of Deficiency

Citrus trees do not appear to have a high requirement for phosphorus and in only a few citrus areas of the world has a need for phosphorus fertilising been established. Symptoms of phosphorus deficiency are an unthrifty, open appearance to the tree and lustreless, bronzed-green foliage. Older leaves may be scorched on tips and margins and fall prematurely.

Lack of phosphorus, unlike that of nitrogen, normally affects fruit quality before it seriously affects yield and growth. Fruits become hollow centred and puffy with coarse rinds and acid juice, especially if nitrogen is abundant. Though tree and foliage symptoms have not yet been definitely identified and associated with phosphorus deficiency in New Zealand, typical fruit symptoms have been observed.

Need for Phosphorus in N.Z. Orchards

Most citrus soils in New Zealand, except those on the Gisborne plains, are low in available phosphorus and despite their low phosphorus requirement citrus trees in all districts except Gisborne are likely to need phosphatic manuring. There is no doubt that cover crops in citrus orchards respond to applications of phosphorus.

Phosphorus is readily fixed in the first few inches of soil, especially at Kerikeri, and much of the phosphorus applied never reaches the main root zone of the tree. Better penetration of phosphorus fertiliser may be achieved by applying it all when sowing a cover crop. Not only is the cover crop stimulated, but as phosphorus is concentrated in the growing root tips of the crop it will be released at the rooting depth of the trees when the crop is turned in and dies.

Kerikeri soils and some soils at Henderson and Huapai are naturally very acid and have a high capacity for fixing phosphorus. In these cases phosphatic fertilisers are likely to be most effective when applied with lime.

There is little experimental evidence in New Zealand on which to base phosphorus fertilising recommendations for citrus. In a fertiliser experiment with lemon trees at Tauranga from 1930 to 1934 tree yields benefited from annual applications of 6 cwt of superphosphate per acre compared with trees receiving no phosphate.

As a general guide it is suggested that phosphatic fertilisers should be applied to bearing trees at the rate of about 100 to 150 lb of phosphoric acid (P_2O_5) equivalent per acre. This amounts to about 4 to 6 cwt of superphosphate per acre.

Sources of Phosphorus

Animal manures and all forms of vegetable mulch contain some phosphorus. Other organic but more concentrated phosphatic fertilisers in common use are: Bone dust, which contains the equivalent of 20 per cent to 28 per cent insoluble phosphoric acid and about 3 per cent to 4½ per

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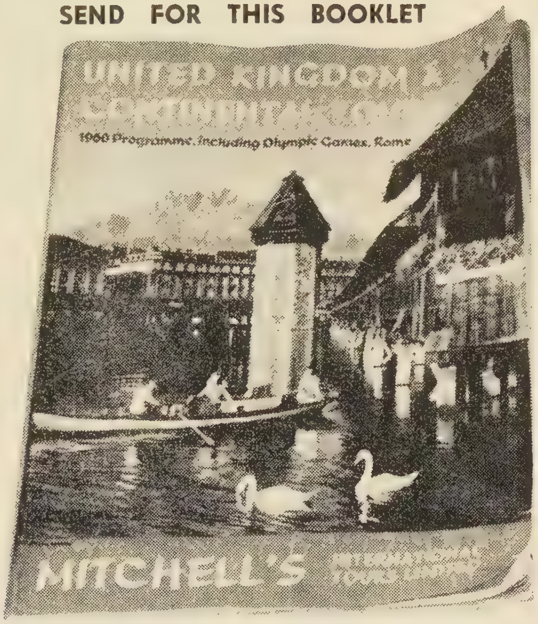
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cent insoluble nitrogen, and blood and bone fertiliser (11 per cent to 12 per cent phosphoric acid and 6 per cent to 7 per cent nitrogen). Chemical phosphatic fertilisers are superphosphate (20 per cent to 21 per cent soluble phosphoric acid), serpentine superphosphate (15 per cent to 16 per cent insoluble phosphoric acid and 7 per cent magnesium oxide), and basic slag (20 per cent insoluble phosphoric acid).

Superphosphate may generally be regarded as the cheapest and most efficient phosphatic fertiliser. Where magnesium deficiency is evident serpentine superphosphate should be used. Basic slag is also a good fertiliser which provides some lime, magnesia, iron, and manganese, as well as phosphoric acid, but this material is more expensive than superphosphate and there are very few soils, if any, on which superphosphate is inferior to slag.

Timing Phosphorus Applications

Timing phosphorus applications is not important for the tree, but separate dressings are probably most effective if applied when sowing the cover crop in autumn for the reasons already mentioned. If phosphatic fertilisers are included in a mixed fertiliser, timing is dictated by the best time to apply the nitrogen.

POTASSIUM

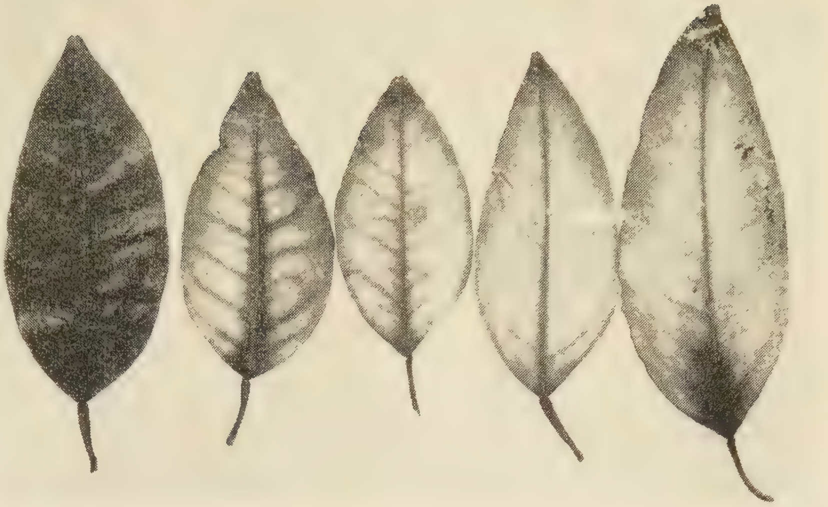
Potassium's role in plant nutrition is still incompletely understood. Most of it remains in solution in the cell sap and it appears to be necessary for carbohydrate, protein, and oil formation. A large potassium supply reduces the intake of magnesium and calcium, and a large supply of either of these latter elements reduces the intake of potassium.

Effects of Deficiency and Excess

Overseas research has shown that potassium, unless it is seriously deficient, does not greatly affect growth or yields of citrus. Symptoms of deficiency are premature leaf fall and lustreless, bronzed, and sometimes puckered leaves which may exhibit characteristic marginal scorching. Sometimes leaves are spotted or stippled with yellow. The fruit may be small with very thin rinds.

These symptoms have not yet been observed and definitely associated with potassium deficiency of citrus trees in New Zealand, but available potassium is low in many citrus soils, especially at Kerikeri and Auckland, so that maintenance dressings of potash appear to be warranted in these districts.

Though some soils in the Bay of Plenty are better supplied with potash, a fertiliser trial carried out at Tauranga some years ago indicated some response to potash applications. Gisborne soils are rich in potash and further applications could adversely affect fruit quality and are likely to induce or aggravate a magnesium deficiency.



Chlorosis of New Zealand grapefruit leaves that is typical of magnesium deficiency; a healthy leaf is on the left.

Potassium probably has a greater effect than nitrogen on fruit quality. Recent work in Florida has shown that a high level of nitrogen produces high yields of good-quality fruit provided the amount of potash is held at a moderate to low level. Many growers in New Zealand, following practice in pip fruit orchards, where high potash is applied to improve fruit colour and quality, have used high rates also on citrus trees for the same reason. There is considerable evidence, however, that this practice has been defeating the very purpose for which it was intended and instead of producing high-coloured, good-quality fruit, large, coarse, and poor-coloured fruit, often with little juice, has been obtained.

Amounts of Potash to Apply

Unfortunately there has been no experimental work in New Zealand to determine what are the best rates at which to apply potash to citrus trees in the various districts, but as a general guide it is suggested the rates should not exceed more than about half the rate of nitrogen applied. In bearing orchards this would amount to about 75 to 100 lb of potash equivalent (potassium oxide) per acre. In orchards where potash levels are very low it may be beneficial to apply as much potash as nitrogen, amounting to 150 to 200 lb of potassium oxide per acre. Heavier dressings than this are probably of no benefit and may coarsen the skin of the fruit.

Sources of Potash

Animal manures and other bulky organic matter provide some potash, and fresh fowl manure is very high in this nutrient. The most common forms of potassic fertilisers used, however, are sulphate of potash (48 per cent potassium oxide) and muriate of potash (60 per cent potassium oxide).

Muriate of potash is a cheaper source of potash and there is no evidence that it is in any way inferior to sulphate of potash as a fertiliser. It requires 2 lb of sulphate of potash and $1\frac{2}{3}$ lb of muriate of potash to apply 1 lb of potassium oxide.

Timing Potash Applications

These fertilisers are readily soluble and are probably best applied in two dressings with the nitrogen applications.

CALCIUM

Calcium neutralises organic acids and toxic substances forming in the plant and it appears to be important for root growth and functioning. As calcium pectate it forms an important part of cell walls.

Applied as lime it helps to reduce phosphate fixation by aluminium and iron in the soil and it reduces soil acidity.

Calcium deficiency as such has never been reported in the field on citrus. Most soils have ample calcium, or ample for the trees' needs is supplied in lime or incidentally with fertilisers such as superphosphate.

Liming to reduce soil acidity is the most common use of calcium in New Zealand and this aspect is discussed in the concluding section of this article.

MAGNESIUM

Magnesium is a constituent of chlorophyll and is closely connected with the development of seeds. An adequate level of magnesium in the tree also appears to aid the uptake of manganese and zinc.

Deficiency Symptoms

Magnesium is highly mobile in the tree and deficiency symptoms are associated with its movement from older leaves to maturing fruits and younger leaves. Irregular interveinal yellow blotches first appear along either side of the midrib and these gradually spread until the whole leaf may be yellow except for the tip and a more or less characteristic wedge of green at the base.

Symptoms occur most commonly on leaves adjacent to developing fruits and usually appear in late summer and autumn. Affected leaves drop prematurely during winter, especially during cold spells, and trees may become severely defoliated. Evidence of this has been observed with Wheeny grapefruit trees after a heavy crop in an "on" year.

Magnesium deficiency tends to aggravate biennial cropping and also causes a reduction in yields, size, and quality of fruit. Fruit tends to be coarser, not so well coloured, and is more susceptible to break-down in storage.

Magnesium deficiency symptoms have been observed in all districts and these have been confirmed by leaf analysis at Kerikeri. On very acid soils such as at Kerikeri and Auckland deficiency is probably due to leaching, but at Gisborne the deficiency is more probably induced by the high level of potash in the soil. It is also likely that heavy dressings of potash have induced magnesium deficiency in some orchards.

Though there is no doubt that magnesium deficiency occurs in New Zealand citrus orchards, limited experimentation at Kerikeri and Bay of Plenty with soil and foliar spray treatments was not very successful. Overseas research suggests that foliar sprays are ineffective and it is now considered that the rate of soil dressings of magnesium used in our experiments was probably too low to be effective. Recent grower experience at Kerikeri, however, has shown that a magnesium deficiency in Wheeny grapefruit was corrected with soil dressings of epsom salt at 10 lb per tree applied in two dressings.

Sources of Magnesium

Sources of magnesium available in New Zealand are dolomite (a mixture of calcium and magnesium carbonates), magnesite (magnesium carbonate), serpentine (magnesium silicate), kieserite (magnesium sulphate), and epsom salt (magnesium sulphate). Dolomite and magnesite have a liming effect on the soil and are suitable for use on acid soils only. The other materials can be used on all soils.

Treating Deficiency

In orchards where magnesium deficiency appears to be well established it is suggested that an initial dressing of 1½ to 2 tons per acre of dolomite or about the same quantity of talc magnesite be applied to acid soils. Overseas experience suggests that recovery may take 2 to 3 years and should be followed by annual dressings of about 5 cwt of dolomite or talc magnesite per acre until further appearance of symptoms is unlikely.

On alkaline soils such as those found at Gisborne or on acid soils where a quicker response is sought, epsom salt or kieserite may be used. Epsom salt should be initially applied at the rate of about 10 to 20 lb per tree (depending on its size) or 15 cwt per acre and kieserite, which contains nearly twice as much magnesium, should be used at about half this rate. It may take a year for any appreciable response, but the effect should last several years. Thereafter annual maintenance dressings of 2 to 2½ cwt of these materials per acre may prevent reappearance of symptoms.

Serpentine superphosphate applied at the rates suggested to satisfy phosphorus requirements also supplies appreciable amounts of magnesium, and this form of superphosphate is recommended for use in all citrus orchards to help prevent development of magnesium deficiency.

Liming the soil to a pH of about 6 is probably beneficial to reduce leaching losses of magnesium, but will not correct symptoms if magnesium levels in the soil are low.

There is no evidence that applying magnesium supplements is of any benefit to citrus trees unless there are obvious leaf symptoms; so growers should avoid making unnecessary applications of these fertilisers.

SULPHUR

This element is a constituent of proteins and is used by trees in about the same quantities as phosphorus. Sulphur is applied incidentally with fertilisers such as sulphates of ammonia, potash, and calcium (in superphosphate) and in copper sulphate in bordeaux spray mixture. No deficiency of sulphur has ever been observed in New Zealand citrus trees; nor is it ever likely to occur.

(To be concluded)

Control of Thistles in Pastures

As scotch, winged, variegated, and nodding thistles establish readily from seed, successful control of them depends not only on effectively killing the plants but also on the improvement of the sward cover and the general vigour of the pasture.

Young pastures are best sprayed with MCPB or 2,4-DB at 1 lb acid equivalent per acre, as these preparations have little effect on clovers. At the time of spraying the clovers should have not fewer than three true leaves. Ample topdressing is also essential.

Spraying is best done on established pastures in early spring before clover growth has begun and when most of the thistle seed will have struck. At this time the plants will be in the seedling to early rosette stages and little smothering of the pasture will have occurred. The pasture should be closely grazed to expose the thistles and reduce clover damage. From ½ to 1 lb acid equivalent of either the potassium salt of MCPA or the salt or amine of 2,4-D is sufficient for control at this stage.

Beside the oversowing and topdressing of undeveloped areas on hill country, the sowing of slips and bare patches left by thistles is important. *Paspalum dilatatum* and especially *Phalaris tuberosa* show considerable promise as colonisers of bare patches and also of sheep camps where the fertility is too high for other grasses.

Californian thistle is difficult to control with hormones in old pastures, especially in deep free-draining soils, because the weedicide is not carried down to kill much of the extensive underground root system and fresh suckers arise from unaffected laterals.

Too often a single spraying achieves little more than the equivalent of a mowing at the flower stage. Repeat annual sprayings for several years by use of MCPA or the amine of 2,4-D at 1 lb acid equivalent per acre at the early bud stage are usually required for good control. This is, however, costly and often very damaging to the clovers.

Where practicable the best control can be obtained in conjunction with cultivation, because the roots are then chopped up into short lengths. Spraying can be done in resistant crops such as the cereals by use of MCPA or 2,4-D at 1 lb acid equivalent per acre or in new grass in spring by use of 1 to 2 lb of 2,4-DB or MCPB, which does not affect the clovers.

Control measures for weeds often need to be adjusted to suit local conditions.

—*L. W. BLACKMORE,*
Instructor in Agriculture,
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Dannevirke

Recent Research Work

YIELD RESPONSES TO PHOSPHATE IN MALTING BARLEY TRIALS

EXTENSION Division trials with malting barley in four seasons show clearly that this crop is markedly responsive to phosphate fertilisers. The trials were sown by Instructors on cooperating farmers' properties on land normally used for malting barley production and in the usual conditions of crop rotation.

INVESTIGATION CONTINUING

THE investigation is continuing and more comprehensive results will be available in a few years. The need of malting barley for phosphate contrasts strongly with the need of wheat, where responses if present are usually 1 to 2 bushels per acre only.

The results in the table below are given as bushels-per-acre increases of malting barley compared with "no phosphate applied". It will be seen that the two forms of phosphate were not compared in 1957-58 and 1958-59. The rates per acre of superphosphate and double superphosphate are equivalent because of the double phosphate content of the latter.

Location of trial	Yield of "No phosphate"	Increases over "No phosphate"			
		Superphosphate		Double super.	
		at 1 cwt per acre	at 2 cwt per acre	at ½ cwt per acre	at 1 cwt per acre
	Bus. per acre	Bus. per acre	Bus. per acre	Bus. per acre	Bus. per acre
1955-56					
Greenstreet, Ashburton	29.0	8.2	12.9		11.2
Spring Creek, Marlborough	47.4	9.9	13.1		11.4
Kaiapoi	97.7	6.2	5.9		5.4
Taitapu	41.9	10.9	14.9		10.8
1956-57					
Spring Creek	76.6	11.0	17.1		18.3
Fernside	30.2	8.0	16.2		12.6
Blenheim	55.3	6.3	3.6		3.9
Greenpark, Christchurch	48.5	14.6	17.1		18.4
Leeston	48.0	12.5	14.6		13.4
Georgetown, North Otago	54.2	5.2	6.6		5.6
1957-58					
Flaxton, North Canterbury	78.1	6.1	10.9		
Rangiora	78.0	17.0	19.5		
Tokarahi, North Otago	50.4	7.2	6.6		
1958-59					
Rangiora	31.0			14.7	21.0
Flaxton, North Canterbury	58.3			6.5	9.0
Lowcliffe, Mid Canterbury	85.7			5.6	12.6
Studholme, South Canterbury	45.9			8.4	13.2

All of the increases shown in the table above are statistically significant increases over "no phosphate", except in two trials. At Blenheim in 1956-57 1 cwt of superphosphate was significantly better than "no phosphate"; the other two treatments did not achieve statistical superiority over "no phosphate". In the Georgetown trial of 1956-57 there was no significant difference.

Statistically significant differences between 1 and 2 cwt of superphosphate were as follows:

1955-56	Greenstreet	1 per cent level
	Taitapu	5 per cent level
1956-57	Spring Creek	5 per cent level
1957-58	Flaxton	1 per cent level

In the 1958-59 trials differences between rates of double superphosphate were statistically significant at:

Rangiora	1 per cent level
Lowcliffe	1 per cent level
Studholme	1 per cent level

ADDITIONAL YIELD INCREASES

Thus in seven trials additional yield increases have been obtained by using 2 cwt of superphosphate or its equivalent of 1 cwt of double superphosphate.

The results of trials indicate:

1. At least 1 cwt of superphosphate or its equivalent of ½ cwt of double superphosphate per acre should be used with malting barley in Marlborough, Canterbury, and North Otago.

2. Superphosphate and double superphosphate are both efficient phosphate fertilisers for malting barley.

Double superphosphate contains relatively little sulphur compared with superphosphate, but in the main malting barley districts appreciable sulphur deficiencies have not occurred. There is one exception in the trials listed. At Tokarahi, North Otago, in 1957-58 double superphosphate was used in "buffer plots" and gave relatively lower yields, which, however, could not be compared in statistical analysis with superphosphate because of the trial design. The soil type of this trial, however, is known to be sulphur responsive.

—K. COTTIER, *Wellington*

Place of Paspalum in Waikato Pastures

By J. KARLOVSKY,
Scientific Officer, Department of Agriculture Rukuhia Soil Research Station

PASPALUM appears to have a place on dairy farms on the meadow soils of the Waikato, except that on limited areas close to milking sheds and along stock tracks where fertility and stock concentrations are very high, it may disappear from the sward. The position of paspalum on the drier soils has yet to be ascertained. Trials have been laid down to follow the effect of paspalum on production at all times of the year.

STANDARD perennial ryegrass-short-rotation ryegrass-white clover pasture in the Waikato falls off in production very rapidly during the hot, dry summer months. While not serious on sheep farms, the drop in pasture growth badly affects production on dairy farms and has led to the use of irrigation. Summer-growing grasses, particularly paspalum, assist summer production, but whether the beneficial effect of such grasses in the summer is offset by a detrimental effect on winter production has always been a controversial subject.

The first soil selected for trial was a meadow one, Te Kowhai clay loam, which under high-fertility conditions gives high production of perennial ryegrass, short-rotation ryegrass, and white clover. The aim was to discover how this type of pasture compared with one containing the same species plus paspalum.

The field for the trial was ploughed, cultivated, and sown with white-fleshed turnips on 31 October 1955. Half of the area was sown at the same time with an extremely heavy seeding of paspalum to get an immediate establishment of this grass. This was achieved and after the turnip crop was fed off the whole area was disced and oversown with 20 lb of perennial ryegrass, 20 lb of short-rotation ryegrass, and 3 lb of white clover.

Unfortunately bad weather delayed the sowing until 4 May 1956, and as the establishment of the ryegrass was rather poor, the whole area was oversown next spring with a very heavy seeding of perennial ryegrass. This resulted in the desired establishment, on one side a thick sward of ryegrass and white clover and on the other the same thick growth plus paspalum.

The object was to have the ryegrass so thick that the presence of paspalum would not be noticed in walking over the paspalum-sown portion of the field in late winter and early spring, and in summer to have dominant paspalum with ryegrass noticeably present. This was achieved. Botanical analyses of herbage samples showed that in winter there was 70 per cent of ryegrass and only some 5 per cent of paspalum, while in summer the position was reversed, the paspalum gradually taking the place of ryegrass until the sward contained over 80 per cent in February.

COMPARISON OF RYEGRASS-WHITE CLOVER PASTURE AND PASPALUM-RYEGRASS-WHITE CLOVER PASTURE

Season	Ryegrass-white clover lb dry matter/acre	Paspalum-ryegrass-white clover lb dry matter/acre	Relative yields*
Part spring 1956	1,250	1,040	83
Summer 1956-57	2,500	3,640	146
Autumn 1957 ..	1,920	2,010	105
Winter 1957 ..	1,670	1,600	96
Spring 1957 ..	4,990	5,650	113
Summer 1957-58	3,170	4,150	131
Autumn 1958 ..	2,880	3,820	133
Winter 1958 ..	1,440	1,240	86
Spring 1958 ..	4,260	4,870	114
Total 2 years	24,080	28,020	116

* Yields of the sward containing paspalum relative to the no-paspalum pasture = 100.

Conclusions

1. Pasture production in the Waikato on fairly fertile meadow soils can be increased by the inclusion of paspalum in standard perennial ryegrass-short-rotation ryegrass-white clover pastures.
2. The greatest benefit from paspalum is obtained in the summer and early autumn.
3. If the ryegrass content of the sward is maintained by good management, there is little lowering in winter production from such swards.
4. It is recommended that where summer production is a problem, paspalum should be introduced in a few suitable paddocks and topdressing should be applied in November instead of in autumn.

On the non-paspalum section ryegrass was dominant in all seasons except summer, when white clover was more abundant and self-introduced grasses including some paspalum, Yorkshire fog, cocksfoot, and sweet vernal were present. The area was well topdressed, receiving 3 cwt of serpentine superphosphate plus 10 cwt of lime with the turnips and since then 4 cwt of superphosphate annually with an extra dressing of 10 cwt of lime and 2 cwt of muriate of potash in 1958.

The table at left shows yields from late 1956 until spring 1958. The main features of the trial are the high summer production from the paspalum section and a winter production only slightly lower than in the no-paspalum counterpart. The summer production on the paspalum block has been 46 per cent higher in 1956-57 and 31 per cent higher in 1957-58 and the total production 16 per cent higher. In mid-summer dry weather the paspalum block was conspicuously greener than the other block. The trial was not replicated. Four movable frames were cut in each block and showed that each block was reasonably uniform.

Opponents of paspalum generally concede that this grass is more highly productive in summer, but consider that its presence results in drastic lowering of production in winter and spring. The trial shows that if the correct balance is maintained between ryegrass and paspalum the lowering in production in winter is slight.

Unfortunately not many farmers manage paspalum properly to ensure that a high percentage of winter-growing ryegrass is maintained in the sward. If this is accomplished, the problem of summer production is largely overcome, with only a slight reduction in winter production.

Most of the hostility to paspalum has been incurred because of its mismanagement. It is a vigorous summer producer and its growth must be controlled in summer. If it is not, it will smother ryegrass and white clover and the whole pasture will become unthrifty and low producing even in summer. Ryegrass and white clover may also disappear from the sward because of insufficient or unsuitable topdressing, for under conditions of low fertility the much hardier paspalum will survive, but remain unthrifty and low producing. The ryegrass and white clover can be revived by topdressing and proper control of paspalum, with oversowing or undersowing when needed.

Paspalum should not be allowed to run to stem in summer and the mower should be brought into action if stock cannot manage its growth. In wet summers when growth is more than that required for stock needs, paspalum pastures can be shut up briefly for a cut of silage in the leafy stage.

Paspalum will not stand high fertility and treading to the same extent as perennial ryegrass, and when fertility and stock concentrations are very high, paspalum may disappear from the sward. This is common close to milking sheds and along stock tracks. Except for such limited areas, paspalum appears to have a place on dairy farms on the meadow soils of the Waikato. The position on the drier soils has yet to be ascertained by trials to be laid down shortly.

Erratic Cropping of Winter Nelis Pears in Hawke's Bay

By N. B. CONGDON, Instructor in Horticulture, Department of Agriculture, Hastings, and C. E. WOODHEAD, Pip Fruit Specialist, Department of Agriculture, Palmerston North

ERRATIC cropping of Winter Nelis pears in Hawke's Bay is not due to a nutritional deficiency in the soil. This has been shown by a Horticulture Division trial which was laid down to ascertain whether poor crops were caused by a deficiency of nitrogen, phosphate, or potash or all three. During the investigation, however, it was found that inadequate pollination was the primary cause of poor crops. The trial was laid down in 1954 in the Grasmere block, Havelock North, formerly a single orchard of 70 acres consisting mainly of pears but later subdivided into several blocks for the settlement of ex-servicemen. Two of these orchards were included in the trial.

IN addition to a basic dressing of 10 lb per tree of a local orchard mixture, some trial plots received 10 lb per tree of sulphate of ammonia, superphosphate, or sulphate of potash. One plot was given 30 lb per tree of the orchard mixture only and another had three foliar sprays of urea at 5 lb per 100 gallons in addition to the base dressing. Treatments were applied annually for three years. Trees receiving the heavy additional amounts produced little or no better crops than those receiving only the base dressing of 10 lb of orchard manure.

Pollination

All Winter Nelis trees in the trial were 2 rows away from any other pear variety. Observations in the trial orchards and in other Grasmere orchards revealed that the cropping of Winter Nelis was greatly influenced by cross pollination.

Originally this variety was planted in solid blocks in this area, but growers, suspecting that some benefit might be obtained by mixing varieties, have gradually reworked rows of Winter Nelis, mainly with Williams' Bon Chretien. The presence of these topworked trees, now in full bearing, has improved cropping.

Each year Winter Nelis trees have carried good crops on the sides facing a pollinator row, whereas inside the block away from the influence of the

[R. W. Orr

Effect of cross-pollination. Left—Beurre Bosc pollinator. Right—Winter Nelis tree on an open, sunny site but carrying the bulk of its crop on the half of the tree adjacent to the pollinator. The branches on this side have been propped to prevent breakage because of the heavy crop.

ERRATIC CROPPING OF WINTER NELIS PEARS . . .

Williams' Bon Chretien (or sometimes Beurre Bosc) pollinator the crop has been very much lighter. As this effect was observed in each of the three years of the investigation, it appears beyond doubt that Winter Nelis produces heavier crops when adjacent to a pollinating variety which flowers concurrently or at least has a blossoming period that overlaps.

Bees

To ensure as far as possible conditions favouring maximum pollination, growers in the Grasmere area introduce a good supply of bees into their pear orchards each spring. In the main these are hired from beekeepers for the blossoming period.

Hives are placed at regular intervals throughout the orchard. Some growers use up to four to an acre, but one is generally considered satisfactory.

The best time to introduce bees is just before full bloom when sufficient blossom is open to attract the bees immediately. If hives are set out too early, bees have little nectar and pollen to gather and go to a more attractive source. Pear blossom nectar has a lower sugar concentration than that of many other trees and plants flowering at the same time. Thus by the time the pears have reached full bloom bees introduced too early may have been attracted to other flowers away from the orchard.

Weather

Unfortunately warm, sunny days, which would provide ideal conditions for setting of the fruit, are unusual during the blossoming period of Winter Nelis. The cold and showery conditions often experienced in late September and early October not only restrict the activity of bees but bring on blossom blast caused by the bacterium *Pseudomonas syringae*, which can reduce a promising crop severely.

However, in orchards attacked by blossom blast but where there has been adequate provision for cross pollination, fruit set and subsequent crop have been better than where pollination has been inadequate.

Ensuring Adequate Pollination

Factors ensuring adequate pollination of Winter Nelis are:

- Warm, sunny weather during blossoming.
- Provision of pollinating varieties which blossom at the same time as Winter Nelis (for Hawke's Bay, Williams' Bon Chretien and Beurre Bosc).
- Planting of Winter Nelis and pollinator variety in alternate rows.
- Introduction of bees a few days before full bloom (one strong hive per acre of pears at intervals throughout the orchard).

It is not suggested that fertilisers are not of importance in cropping of Winter Nelis pears, but no treatment can be fully effective in increasing production while fruit set is limited by inadequate pollination.

Acknowledgment

The authors wish to acknowledge the cooperation of Messrs H. B. Deeley and E. Bixley, Grasmere, on whose properties the trial was carried out.

Book Reviews

"The Wheat Varieties of N.Z.": J. M. McEwan

THIS publication (Department of Scientific and Industrial Research Bulletin 131) presents concise descriptions of wheat varieties grown in New Zealand during the last 40 years and will be useful to those who are interested in wheat growing in New Zealand.

The information contained has not previously been assembled in so compact a form. Each of eleven varieties, ranging from Solid Straw Tuscan and Hunters to the new varieties Aotea and Arawa, is described under the following headings: Origin, general characteristics, juvenile and adult habits, spike and grain descriptions, disease reaction, yield, and milling and baking quality.

Though a certain amount of necessarily technical language is used, the varietal descriptions will be of interest to the practical as well as the technical agriculturist. The bulletin includes black and white plates of head and grain characteristics and an appendix of New Zealand wheat varieties classified in the FAO catalogue of genetic stocks.

—*K.C.*

Department of Scientific and Industrial Research. 3s.

"Machines on the Farm": H. J. Hine

THIS book is a departure from the usual text book which describes how to operate and maintain farm machinery, because it also shows how farmers can gain the fullest benefit from their machines by adopting the industrial techniques of production planning.

Farming is probably the oldest production industry and the advent of modern machines brings new considerations in that machines must be chosen, operated, and maintained with prudence and economy. The application of production planning and method study to farming ensures machines being used in the right way at the right time and in the right place. This is important, as machines form a large part of the capital cost of farming.

The book has chapters dealing with every type of machine for arable work likely to be found on the farm and covers their setting, maintenance, and operation for greatest efficiency.

Success in farming depends largely on getting the greatest output with the smallest expenditure of money and time, consistent with maintaining land in good heart. Machinery is one of the most important factors in helping toward this end, and knowledge of its correct operation and maintenance is as essential to the prosperity of the farm as knowledge of stock breeding and crop growing. This book will supply this knowledge.

—*H.W.T.E.*

Odhams Press Ltd. 25s. net

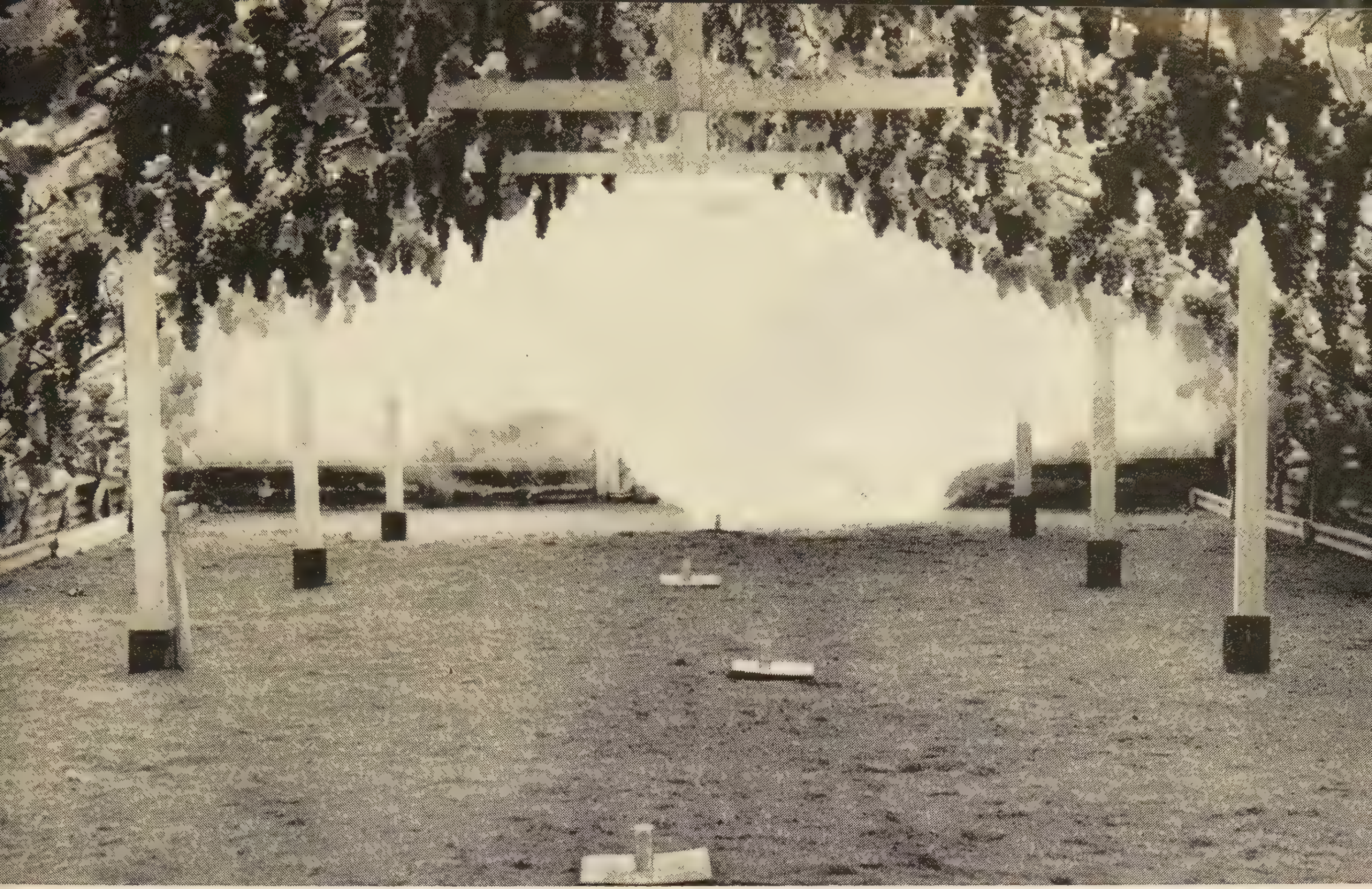
Courses for Shearers

COURSES for 1959-60 for senior and junior shearers, conducted by the New Zealand Wool Board, will be held at Massey Agricultural College from September to February and at Canterbury Agricultural College, Lincoln, from August to February. Full details are available from the nearest provincial office of Federated Farmers, who are responsible for selecting trainees.

It is emphasised by the Wool Board that the courses are not for complete novices. Such a beginner should receive his first instruction from a provincial shearing instructor of the Wool Board and should be able to handle sheep and a handpiece before attending a college course.

The course for senior shearers is for a week and is for men who can shear 120 sheep and more a day. For juniors (men who can shear up to 120 sheep a day) the course is for two weeks, beginning on Tuesday of one week and finishing on Thursday of the following week.

Accommodation and instruction costs at the colleges will be paid by the Wool Board, but travelling expenses to and from the colleges must be met by trainees.



[*Sparrow*

Insecticidal smoke generator for control of insect pests in a glasshouse vinery. The unlit generators in the foreground show how they are positioned to give coverage throughout the glasshouse.

Control of Pests and Diseases of Glasshouse Grapes

By F. BERRY-SMITH,
Viticulturist, Department of Agriculture, Auckland

EFFICIENT control of insect pests and fungous diseases is essential if good crops of high-quality grapes are to be obtained from a glasshouse vinery. It is commonly believed that all that is involved in the control of pests and diseases is the timely application of the appropriate insecticide or fungicide. This is a misconception, because the incidence and persistence of pests and diseases are largely influenced by the standard of glasshouse management. If cultural methods and vinery sanitation are faulty, best results cannot be expected from the various therapeutants.

VINES weakened through inadequate or unbalanced nutrition, defective drainage, overcropping, or other unfavourable conditions are more susceptible to attack from pests and diseases. Poor ventilation, dirty glass, congestion of the foliage, leaks in the roof, weeds, and debris are a few other potential causes of trouble which must be attended to first in any programme for controlling pests and diseases. Because most sprays are liable to leave disfiguring residues on the berries, smear the glass, or damage paintwork, therapeutants are applied mainly as dusts, aerosols, or smokes.

Disease Control Programme

The following programme for control of pests and diseases has given good results in many glasshouse vineries throughout New Zealand:

1. Shortly after pruning, all loose bark should be stripped from the rods and burnt with the prunings and fallen leaves. These and other debris provide refuge for insects and disease spores over winter.

2. When the buds are swelling apply a lime sulphur spray at a strength of 1 in 10 to which has been added DDT 20 per cent emulsion at 1 pint in 10 gallons. To avoid smearing of the glass and paintwork the rods should be lowered for the operation. Often the rods are left in the lowered position until the base buds have broken, obtaining a more even break throughout the length of the rod. The use of S-shaped hooks simplifies the lowering of the rods and replacement of them in position.

Lime sulphur is used to control lecanid scales, vine mite, and mildew; DDT for mealy bug, vine weevil, and thrips.

3. When the shoots are 4 to 6 in. long the house should be fumigated with a parathion smoke and the operation repeated after an interval of 7 days. Parathion gives efficient control of most insects, including mealy bug and red spider mite, which are the most troublesome pests of glasshouse grapes in New Zealand. As parathion is not capable of killing the eggs, it must be used twice within a

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short period to kill the young insects hatched out after the first treatment before they are sufficiently mature to produce eggs and maintain the cycle of infestation.

Red spider mites and thrips thrive in a dry atmosphere and it is good practice to damp down the house in hot weather to avoid conditions favourable to these pests.

Proprietary brands of parathion smokes are sold with instructions for use, including the number of cubic feet of glasshouse each canister will effectively fumigate. Parathion is very poisonous to human beings and household pets; therefore after canisters are lit the house should be quickly vacated and locked for the fumigation period as a safeguard against unwitting entry.

Parathion must be used only early in the season because of the danger of toxic residues on the fruit. Its use later is also hazardous to the operator because of possible contact with the residues through handling the foliage in the process of training the growth, thinning, and disbudding.

4. When the shoots are about 8 in. long dusting of the foliage with flowers of sulphur should begin and be repeated every 2 to 3 weeks until the berries show signs of colouring. Sulphur dustings are necessary to control powdery mildew (*Uncinula necator*), the most prevalent fungous disease of vines under glass.

Powdery mildew attacks all herbaceous parts of the vine, but does most damage to the fruit, and later in the season special attention should be given to ensure that the berries are adequately dusted. The berries are most susceptible to attack from powdery mildew during the stoning period when about half developed. It is not advisable to sulphur the vines if the temperature is over 90 degrees F, as at high temperatures sulphur can burn the bunches. Proper management is very important for successful control of powdery mildew. The following procedure is recommended:

(i) In the morning open only the top ventilators, leaving the bottom ventilators closed until the moisture condensed on the vine during the night has dissipated. If both top and bottom ventilators are opened first thing in the morning, the draught causes rapid evaporation of the moisture and chills the tissues, creating conditions conducive to infection. At other times of the day throughout the growing season proper air circulation and humidity and temperature control must be maintained by regulated use of both top and bottom ventilation.

(ii) Thin the foliage to prevent overcrowding of the leaves and excessive shading of the fruit. This is important, as powdery mildew thrives among shaded, congested foliage and fruit. High light intensity inhibits the development of the mildew; therefore clean glass and structural design are desirable to admit maximum light. It is wrong to use white paint on the glass to counter sun scorch. This can be avoided by training the foliage well clear of the glass, maintaining proper ventilation and avoiding lush, soft growth caused by excessive use of nitrogenous fertilisers.

5. At early fruit set red spider mites usually reach a peak of activity, if conditions are favourable for their development. For control of red spider at this and later stages, one of the safest and most efficient materials at present is azobenzene. PCPBS aerosols have been used to some extent and have given satisfactory control of red spider, but under certain conditions they appear more likely to cause foliage damage than azobenzene.

Azobenzene smokes or aerosols may be repeated at fortnightly intervals until the berries turn colour. Moist air, dry foliage, and temperature between 70 and 80 degrees F are required for best results. As the proprietary preparations of azobenzene vary, dosage rates recommended by the manufacturers must be followed.

Precautions with Poisonous Sprays

THE following precautions should be observed when poisonous sprays are used:

- Use rubber gloves when handling and avoid contact of the concentrated material with the skin, eyes, and mouth.
- If liquid is spilt on the skin, wash it off *immediately*, using soap and running water.
- When spraying in a glasshouse wear a respirator, protective coat, sou'wester, eye shields, rubber boots, and rubber gloves.
- Avoid eating, drinking, or smoking during spraying operations.
- Leave the spraying areas should headache or tightness of the chest develop.
- After spraying remove protective clothing and wash rubberware, etc., using soap and running water.
- Keep spray materials tightly closed and store in a safe place out of reach of children.
- Dispose of excess spray by draining into a hole and then covering with soil.

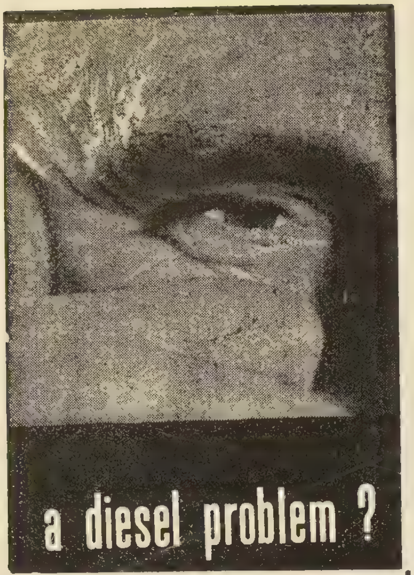
[*Department of Scientific and Industrial Research*

Grape leaf damaged by leaf-roller caterpillar.

Some growers alternate azobenzene with PCPBS with a view to preventing the possible development of a resistant strain of mite to either one of these materials. Late infestation of mealy bug, when the fruit is approaching maturity, presents a difficult control problem because of the risks of marking the berries and the danger of residues remaining at harvest from toxic materials. This emphasises the importance of thoroughness in early control measures.

TEPP (40 per cent) at 1 fl. oz. per 10 gallons may be used to control a late infestation of mealy bug, as no residue, toxic or otherwise, remains after 48 hours. TEPP is highly poisonous to humans and must be sprayed on the vines only by an operator dressed in protective clothing and acquainted with all the necessary precautions to avoid unnecessary risks.

Malathion has been used against mealy bug. It gives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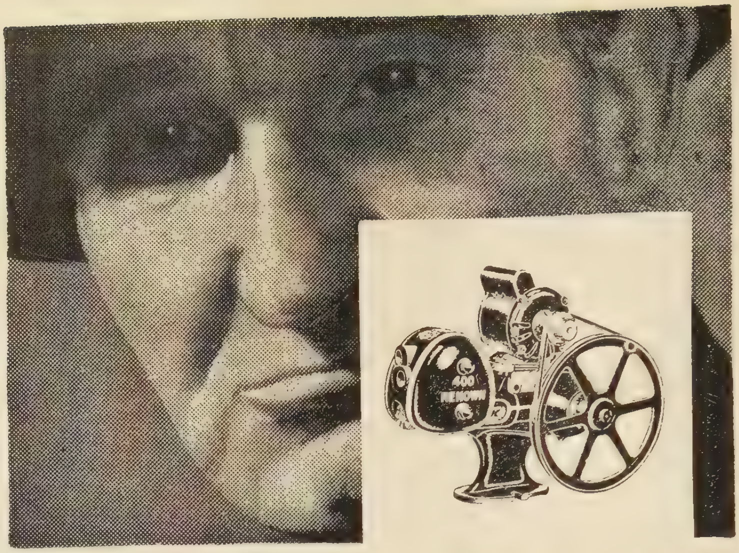

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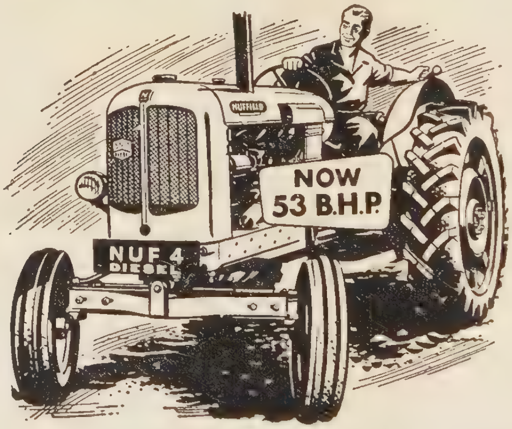

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good control, but is liable to damage the berries. The Gros Colman variety is particularly susceptible to malathion injury and generally its use is inadvisable.

The use of TEPP should be regarded as a last resort and not brought into the programme unless essential.

6. The foregoing cover proven control measures for the common insect pests of the vine and powdery mildew, the most troublesome fungous disease.

Ripe rot, caused by a fungus (*Glomerella cingulata*), and botrytis mould can cause serious losses, particularly on late-market grapes, but damage rarely assumes serious proportions in a well managed, properly ventilated vinery.

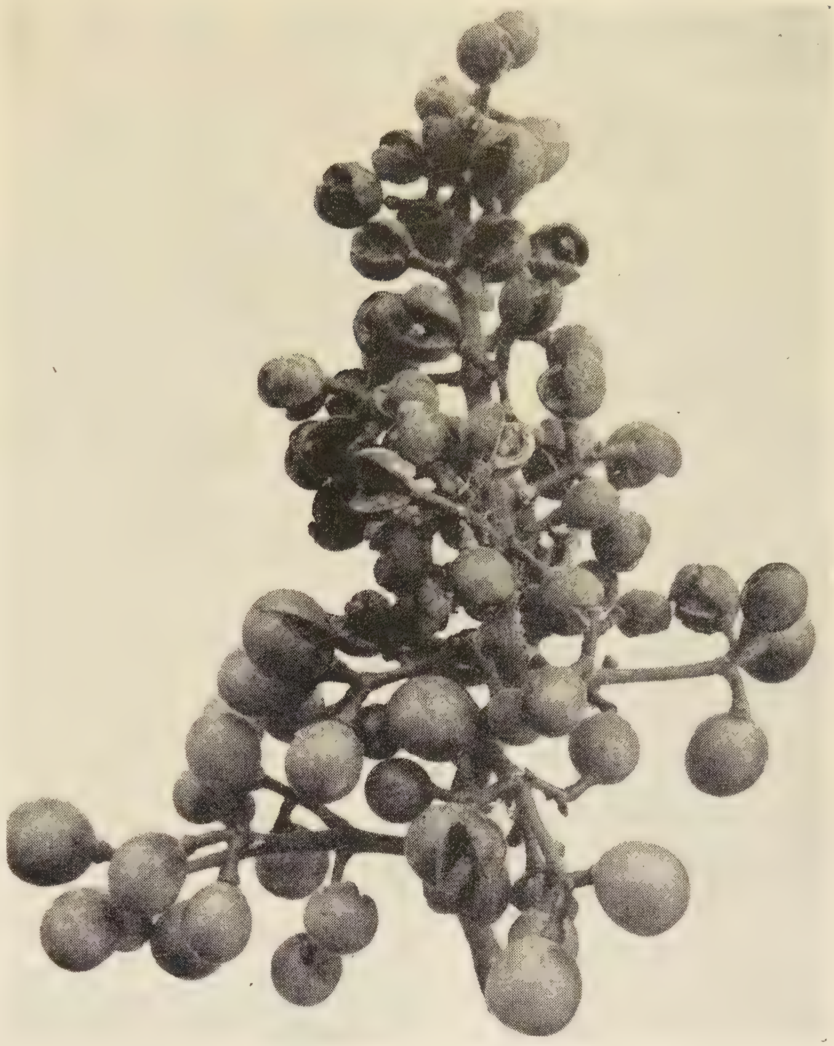
As both ripe rot and botrytis occur on the mature or nearly mature berries, the application of fungicides is usually impracticable because of the likelihood of marking the fruit. Botrytis usually occurs only after physical injury to the berries. Sometimes it is induced by damage to the bunches from leaf-roller caterpillar, but fumigation with parathion early in the season usually gives satisfactory control of this pest. Botrytis may also infect berries which have split from physiological causes. All infected berries should be cut out of the bunches as soon as possible to prevent spread of the disease.

Inadequate thinning of the berries resulting in compact bunches promotes botrytis infection, as moisture inside the bunches dries out only slowly.

Splitting of the berries can be reduced by regular watering of the border during dry weather, thereby minimising the rush of sap otherwise caused by rain on the border after a dry period. Reduction of humidity in the house by full ventilation during overcast conditions or the use of heat where available will also assist to reduce splitting of the berries.

A fungus (*Phoma flaccida*) also causes excoriosis. It mainly attacks vines at the bases of the laterals, which darken, wither, and die. Affected laterals should be cut out and burnt and the affected vines thoroughly sprayed with strong bordeaux mixture (10 : 10 : 50) after pruning. Fortunately, excoriosis is comparatively rare, but has been known to reach serious proportions in certain instances where remedial measures were not taken promptly.

The phylloxera insect, which is liable to destroy the roots of ungrafted vines in infested areas, is worthy of mention, though very few losses of glasshouse vines from this cause have been reported. At present the area infested with phylloxera is confined to all parts north of and including Tauranga. Regulations prohibit the transfer of vines from all infested areas to free areas south of Tauranga unless vines have been sterilised under the supervision of an inspector of the Horticulture Division of the Department of Agriculture.



[*Department of Scientific and Industrial Research*

Powdery mildew damage on immature grapes. The split berries are typical of the disease at this stage.

Many growers have been reluctant to plant grafted vines, because many varieties appear to perform better on their own roots. Grafting is a worthwhile insurance against the depredations of phylloxera in infested areas and if suitable stocks are selected, performance is quite satisfactory. The variety Muscat Hamburgh, which is subject to poor setting and straggly bunches actually sets better-quality bunches on a suitable stock.

Suitable stocks for Black Hamburgh are: 3306, 420A, 41B; for Gros Colman: 420A, 41B; for Muscat Hamburgh: 34 Ecole; and for Muscat of Alexandria: 420A, 101-14. Generally 1202, a popular stock for wine grapes, is not recommended for table grapes, as it fails to induce good setting and colouring with many varieties.

New Fungicide Smoke

Until quite recently the use of smoke generators in glasshouses has been confined to the application of insecticides such as azobenzene, parathion, lindane, and DDT either alone or combined.

Recent trials in England with a smoke generator containing a fungicide, tetrachloronitro benzene (TCNB), gave good control of botrytis and powdery mildew on glasshouse grapes.

Apart from being more convenient smoke generators have the advantage over sprays and dusts of covering foliage more efficiently and penetrating compact bunches and every nook and cranny in the house where pests and diseases could shelter.

Smokes and aerosols are expected eventually to supersede sprays and dusts for the sanitation of glasshouse vineries.

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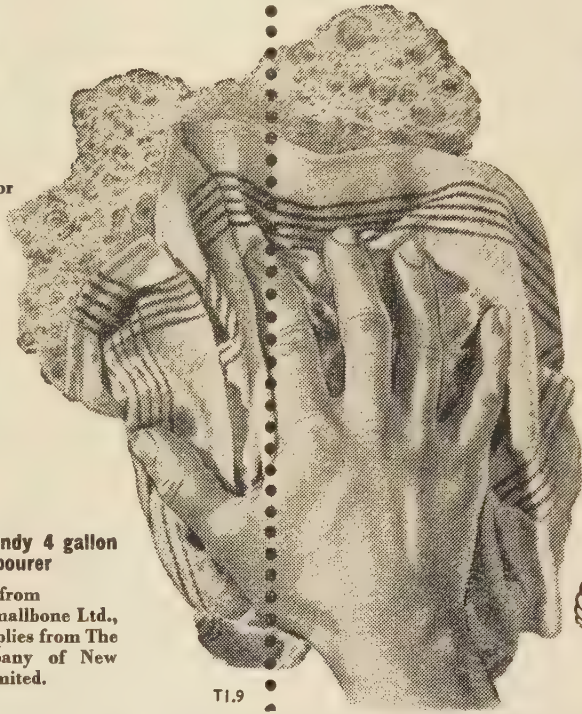

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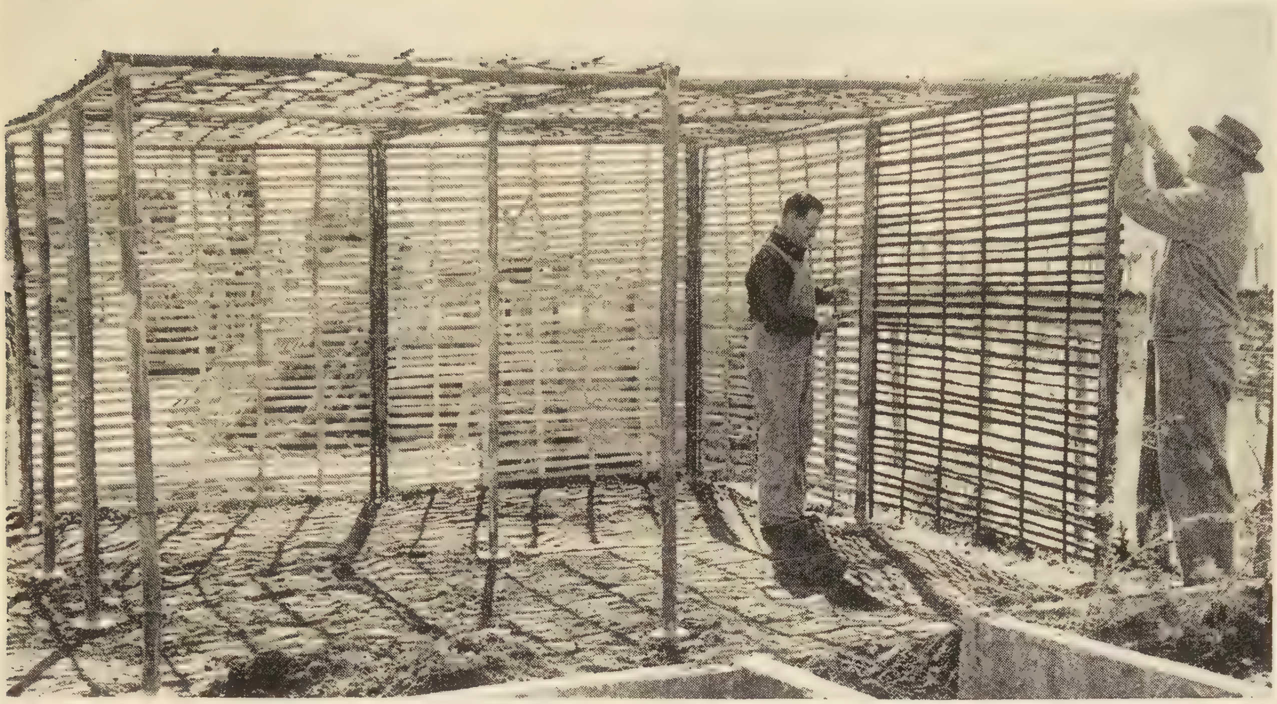
Bamboos and Their Uses

By J. C. GERLACH,
Tropical Agronomist,
Department of Agriculture's
Rukuhia Soil Research
Station, Hamilton



A bamboo lath house being built at the Rukuhia Soil Research Station, showing the system of weaving the strips and the concrete footing of the uprights.

PROBABLY no other group of closely related plants in the world has such a great diversity of uses as the bamboos. The graceful arch of the slender stems and lovely foliage commends them as ornamental plants. As such, they are found in various domains and private gardens in New Zealand, either as a single clump in contrast to heavy evergreen shrubs or trees, or as a hedge along a boundary. The rapid growth and dense foliage of some branching varieties make them suitable for windbreaks and shelter belts. For this purpose the *Pseudosasa japonica*, a thin-stemmed, quickly spreading variety, is mainly used on farms, where it is double fenced, the spread being kept in check by stock eating the young shoots. In the Auckland district several orchards have windbreaks of the *Sinocalamus oldhami*, a 30 to 40 ft tall, fully branched variety, with stems 2 to 3 in. in diameter, which does not spread.

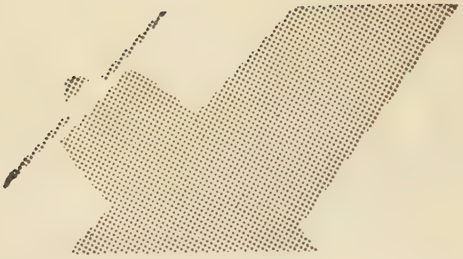
MANY more practical applications become evident, however, once the properties of this excellent plant are better known and one becomes familiar with the handling of the material. The extraordinary strength, toughness, and resilience of the stems, the fact that it is easily split into strips, and other excellent properties make the bamboo suitable for a tremendous range of uses. In the whole of South and East Asia the bamboo is an indispensable material for the building of houses, bridges, paper making, matting, basketry, etc. Japan, for example, has listed 1,400 different uses of bamboos

Strength of Bamboo

In the United States of America, where bamboos are being used increasingly, a series of tests was carried out on the strength of 38 bamboo varieties grown locally. The tensile strength varied between 20,000 and 60,000 lb per square inch and the compressive strength between 6,400 and 13,500 lb per square inch. In comparison the steel in buildings made of steel-reinforced concrete is calculated to have a tensile strength of 20,000 lb per square inch. Most New Zealand native timbers have a maximum crushing strength below the minimum crushing strength of 6,400 lb of bamboos. According to Information Series No. 1 of the New Zealand Forest Service, "Forestry in New Zealand", the strongest wood in this respect is the air-dried southern rata, with a crushing strength of 11,500 lb. When it is realised that the bamboo stem approaches the ideal for structural strength (a hollow, partitioned tube) and is very light, it will be obvious that more use should be made of bamboos in constructional designs where lightness combined with strength is an essential requirement (for example, in scaffolding).

Great Rate of Growth

Bamboo is the quickest-growing timber in the world. From a piece of rhizome, or better still a section of the clump, the plant can usually become well established and produce its normal number of full-sized stems



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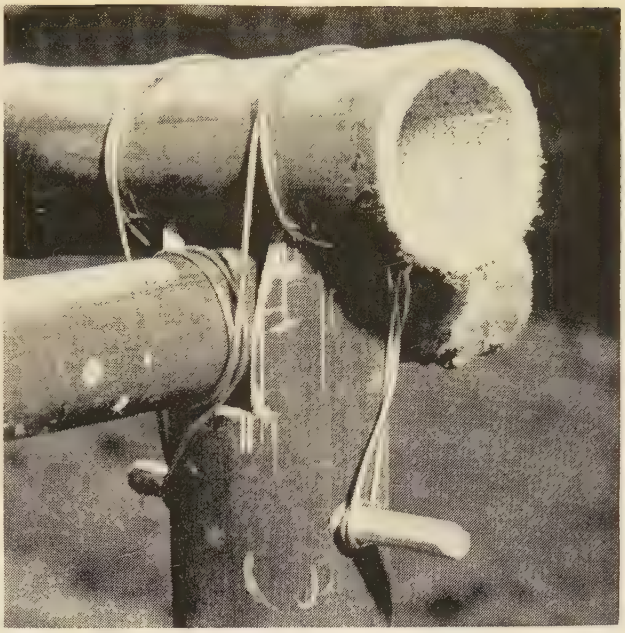
(culms) in three to four years. Depending on the variety, the fertility of the soil, and the climate, 2 to 50 shoots or more are produced each year. Each shoot attains its full diameter and maximum length in six to eight weeks. This means that the tall varieties, over 40 ft high, grow at an average rate of about a foot a day. In Taranaki and Auckland rates of 12 to 17 in. per 24 hours have been observed. In the tropics, where giant bamboos grow to 120 ft and over with a diameter of 12 to 16 in. at the base, the rate of growth may be 27 in. a day.

With this terrific rate of growth it is understandable that the young stem is fairly tender when it shoots up in spring and early summer. It hardens off in a few months, but requires 3 years or more to mature fully. For constructional work only mature stems of not less than three years should be used, as younger stems, not having gained their full strength and hardness, may crack and thus deteriorate earlier.

Construction of a Bamboo Lath House

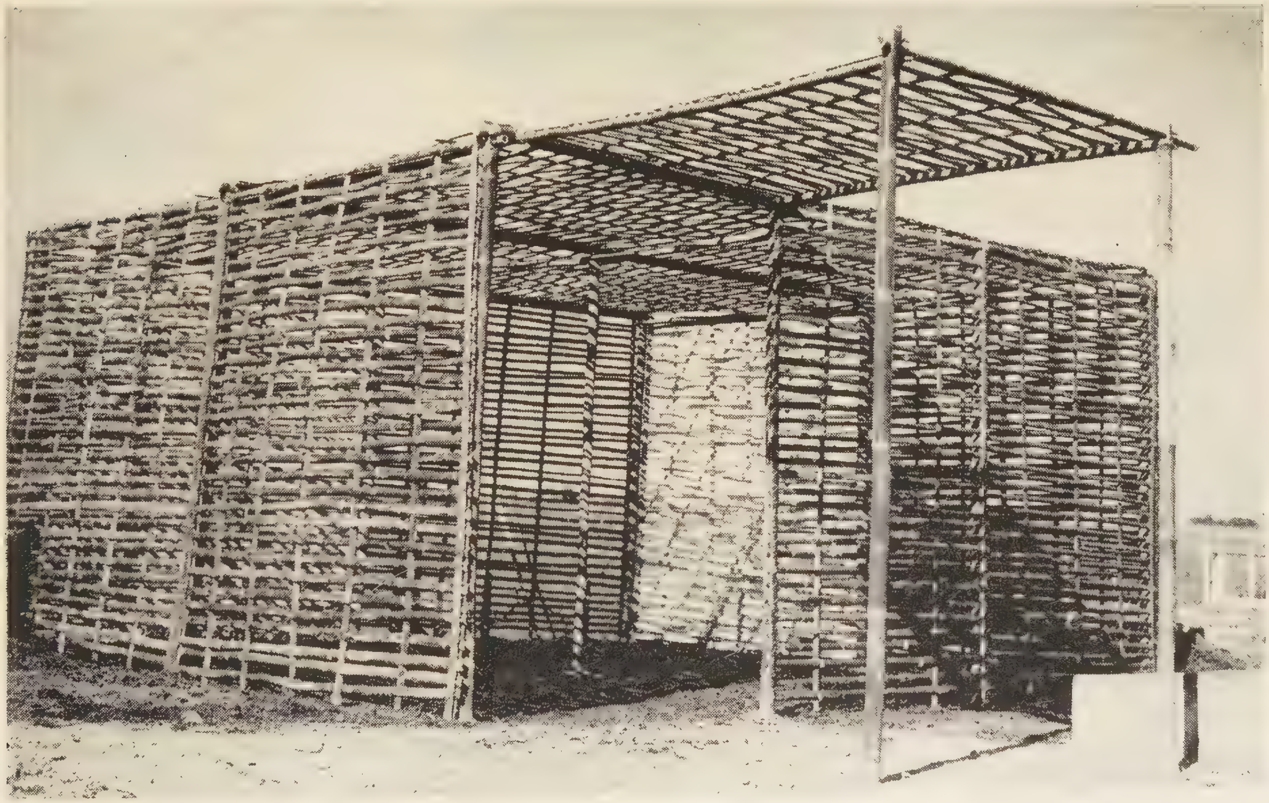
At the Rukuhia Soil Research Station a lath house was wanted for hardening off plant material for trials and growing others in half-shade. It was suggseted that the lath house should be built from bamboo, as this was the cheapest means of construction and would also provide an opportunity of testing the durability of the material under Waikato conditions.

The lath house was designed to have a floor space of 12 x 12 ft with a height of about 6 ft. The bamboos (*Sinocalamus oldhami*) were ordered from an orchardist in Auckland and railed to Frankton in 12 to 15 ft lengths. At the Research Station the culms were cut to size with a carpenter's fine-toothed saw or a hacksaw and some of them split into strips 1 in. wide with an ordinary bush knife. Strips 6 ft 1 in. long were woven, with an inch spacing horizontally, into 10 sections of 6 x 6 ft and three



Method of joining bamboos, showing the wedge-shaped tops of the gaffed upright on to which the top bamboo is pressed down by the wiring to ensure a tight fit.

▼ The finished lath house with the door open.



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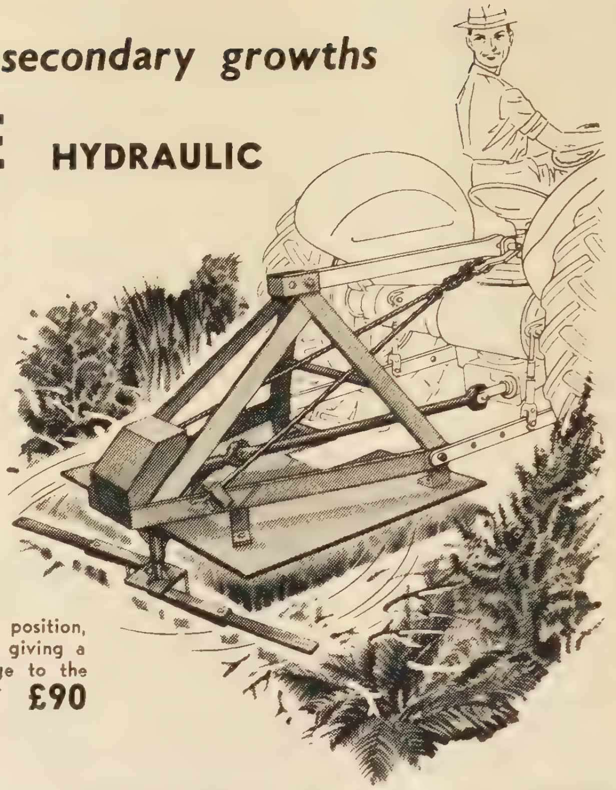

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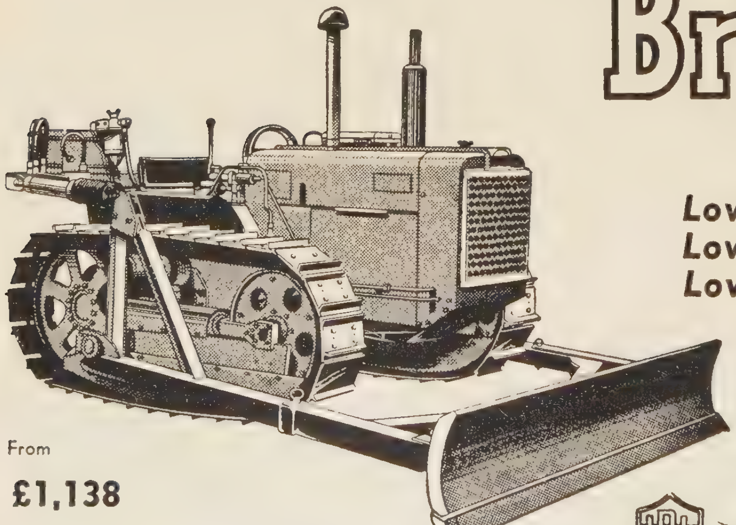

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sections of 6 x 4 ft for the front of the house.

With the aid of a simple wooden clamp to press the protruding ends of the strips in one plane, each end of the sections was provided with a double strip wired on with 20-gauge wire to prevent the slats from moving in the frame. For the 6 x 4 ft door halved bamboos were used to finish the sides, and a thin whole bamboo, a few inches longer than the width of the door, was mounted on the top and bottom. In this way the door could be top-hinged and be kept open on free-standing, gaffed legs, as shown in the illustration on page 585.

The 10 bamboos used for uprights were 7 ft long, one end being cut to fit the joining of the roof and the other painted with roof paint where it was to be inserted in concrete. They were then placed in old 4 in. field tiles sunk into the ground 6 ft apart and filled with concrete, so that the bamboo was standing in and on concrete, the top of the concrete being rounded off to prevent water seepage between the concrete and bamboo (untreated bamboo rots away in the soil fairly quickly).

After the concrete had set, six 12 ft poles were mounted on top horizontally to take the roof sections. Bamboos, having a hollow stem, require of course a different method of joining than wood, and the illustration on page 585 shows how a corner joint is fixed. On to this rigid and strong frame the sections were wired, first the roof, then the walls, and last the door, which was hinged on top with two pieces of fencing wire.

Before the sections were fixed in position the insides of the sections were treated in five different ways to find if there was a simple and cheap way to prevent moulding. In pairs the insides of the sections were sprayed with creosote, copper naphthanate, diesel oil, copper fungicide, and ordinary green roof paint. The diesel oil, control (untreated), and copper fungicide sections, in that order, showed mould within 4 weeks. Six weeks after spraying the sections treated with copper naphthanate showed some mouldy patches, whereas the creosote- and paint-treated sections were still completely free from moulds three months after treatment.

The lath house was built with unskilled labour. As the builders were without previous knowledge of handling bamboos, they were first shown how to split and handle them without cutting themselves on the sharp edges. Split bamboo should always be held at the joint to prevent the piece slipping through the hand.

Costs

In comparison with the cost of a lath house built from wood, for which the material alone (cut timber plus nails) would cost about £45, the cost of a bamboo house works out much more favourably:

Materials		£	s.	d.
80 bamboos of 12 ft and over; 2 to 3 in. diameter		8	0	0
Transport of bamboos from Auckland to Hamilton		2	0	0
Wire			10	0
10 field tiles (4 in.)			10	0
Cement and sand for concrete footing			10	0
		11	10	0
Labour				
Splitting bamboo ..	8 hours			
Weaving and wiring of sections	12 hours			
Levelling tiles, construction of lath house	8 hours			
	28 hours at 6s.	8	8	0
Total		19	18	0

With a floor space of 144 sq. ft., the cost for material worked out at about 1s. 7d. per square foot and the total building cost about 2s. 9d. per square foot.

The advantages of such a lath house for nurserymen and market gardeners are: the lattice work keeps out light frosts (for heavier frosts a covering of plastic sheeting, tagged or stapled on to the bamboo, would be required); young plants, cuttings, etc., are kept in an airy condition without the risk of being damaged by strong winds; the intensity of the sunlight is approximately halved by the latticework of bamboo.

This type of construction enables the lath house to be dismantled and erected in another place in a short time.

Pedigree Pig Improvement Scheme: Qualified Litters

Contributed by the Animal Industry Division

THE following table sets out particulars of litter performance, growth-rate, and carcass quality points for those litters which have qualified in the Pedigree Pig Improvement Scheme for publication since those appearing in the April issue of the "Journal".

Owner		Breeding of litter Sire	 Dam	Date born	Litter weight at 3 weeks	Sex	Dead weight lb	Growth-rate (25)	Length (20)	Carcass test results (average) points Back fat Sh. (10)	 Loin (15)	 Bal. (5)	 Ham (15)	 Sh. (10)	 L. (10)	 B. (5)	 M. (10)	Total points (125)
Porkers A Class																		
G. C. Yeates ..	LW	14777	15452	11/7/58	139	2F	102	18½	19	7—	12—	5	9	6½	5½	2	9	93½
G. C. Yeates ..	LW	15462	14940	9/11/58	129	2F	87	24	16½	8½+	12—	5	9½	7½	7½	4	10	104½
C. I. Wright ..	LW	13590	14336	6/12/58	127	2M	62	14	14	8½—	15	5	10½	8	6½	3½	10	95
C. P. Clout ..	LW	14812	15686	13/10/58	125	2F	74	25	18½	8½—	13—	5	11½	8	7½	4	9	110
I. R. Hunt ..	B	32441	31349	24/11/58	134	2F	82	19½	16½	9+	12—	4	12½	6	7½	4	3½	94½
B Class																		
I. R. Hunt ..	B	31926	31349	30/5/58	117	2F	67	16½	15	8+	8½+	3½	12½	8	7½	3	4	86½
I. R. Hunt ..	B	32441	31928	25/11/58	95	2F	69	11	18	8½+	13—	5	9	7½	6	3	5	86
C Class																		
I. R. Hunt ..	B	31422	30917	30/10/58	92	2F	75	16	11½	9½+	13—	3½	10	7½	7½	4	5½	88
C. I. Wright ..	LW	12432	13810	2/9/59	96	3M	82	14	12½	8½—	14—	3½	11	8	7	4	10	93
Baconers A Class											(20)						(5)	
G. C. Yeates ..	LW	13686	13048	19/7/58	109	2M	138	17	13	10	19½—	4	11½	7½	7½	4	4½	98½
J. Risi & Son	LW	15192	15104	29/7/58	142	2M1F	146	16	18½	5½+	18+	3	9½	6½	6	5	5	93
Seabrook By-products	LW	14661	14924	9/9/58	92	2F	131	18½	16	6½+	11+	5	11	9	7	5	5	94
Producers' Council	LW	13631	13480	6/7/58	132	2M1F	132	13	18	10	17—	2	9	8	7	4	4	92
Producers' Council	LW	14900	13762	4/7/58	103	2F1M	149	14	17	9—	16—	3	12	5	7	5	5	93
Producers' Council	LW	14660	13886	8/7/58	116	1M1F	127	19	19	3½+	15½+	5	8½	7½	6½	4½	4	93
B Class																		
Producers' Council	LW	13631	14053	9/7/58	125	3F1M	135	12½	16	9	11	3½	10½	7½	7½	4½	4½	86½

+ Points lost because too much fat. — Too little fat. L. Loin development. B. Belly thickness. M. Marketing points.

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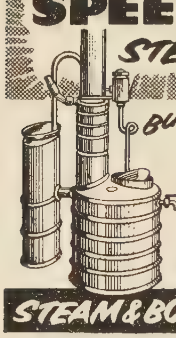

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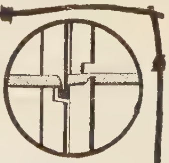

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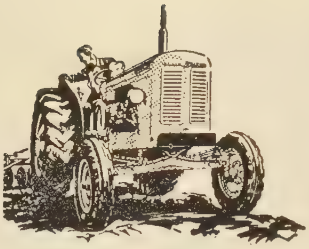

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NEW ZEALAND RAILWAYS

The Home Garden in July

By A. G. KENNELLY,
Horticultural Instructor,
Department of Agriculture,
Dunedin

IN New Zealand the transition from winter to spring is not sharply defined. For that reason there are few areas where it is advisable to make a large sowing of even hardy vegetables in expectation of a progressive improvement in growing conditions from early spring onward. The extent to which sowings of hardy vegetables can be made depends on local conditions, usually largely on ground temperatures, which even in the milder parts of New Zealand are not high enough in July for it to be advisable as a general practice to make large sowings of any hardy vegetable. Small sowings will ensure the continuity of supply of fresh vegetables which is one of the main aims of home production.

WHEN the weather does not permit working on the soil the home gardener should take the opportunity to attend to odd jobs for which there is not always time in the busier seasons. Paths and drains can be installed or improved, and rock, brick, concrete, or even wooden edgings and steps can be built where needed or where they improve the amenities or appearance of the garden. Woody trash can be burnt and other garden residue composted.

Soil and used seed boxes can be sterilised with a 2 per cent formalin solution, tools can be sharpened and cleaned, and bins, shelves, garden seats, trellises, and benches can be built or repaired. Cloches can be cleaned, repaired, or reassembled.

Sowing and Planting

Sow

Broad beans.

Small sowings can also be made in frames where appropriate or outside where conditions are favourable of cabbages and cauliflowers (for late spring or early summer), carrots, lettuce, peas, onions for salad use, silver beet or perpetual spinach beet, spinach, turnips.

Plant

Where soil conditions and temperatures are favourable plant or make preparations for planting: Asparagus and rhubarb crowns, horse radish, shallots, garlic, onions, cabbages, cauliflowers, lettuces, potatoes (in especially early areas).

Winter or early spring, when much ground is being dug over or is vacant, is a good time to apply lime. Rains that are usual before the land is in use again can be expected to help distribute it in depth.

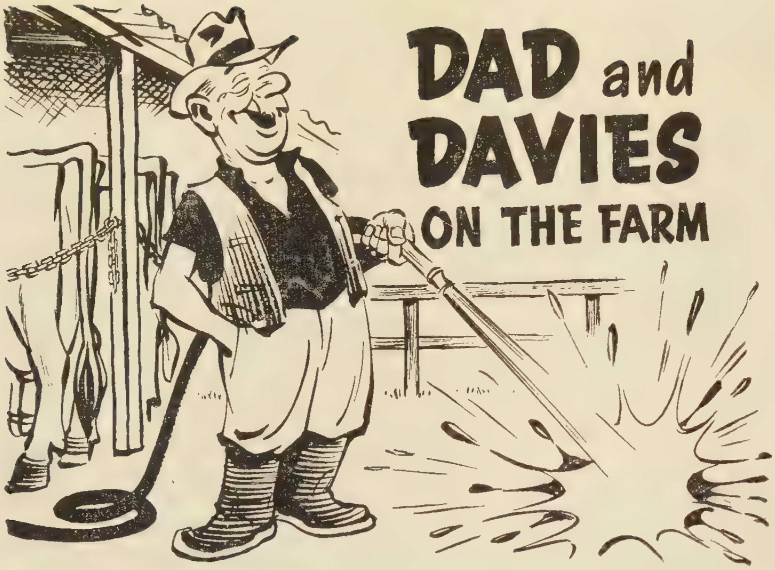
Small sowings of such comparatively hardy plants as broad beans, silver beet, or perpetual spinach beet, peas, spinach, turnips, and even carrots and radish may be made where climate and soil conditions are favourable. Lettuce and summer cabbage and cauliflower can be sown, though in less-favoured districts a frame or specially favourable situation is advisable. If cloches are used, all the seed mentioned can be sown in well-drained soil, but cloches should be in position about a week before sowing.

Hardy plants such as horse radish, spring cabbage, garlic, and shallots, and in North Island districts onion seedlings can be set out if the soil is in good working condition. Where the weather is not too severe lettuce and cauliflower can also be set out, preferably in most districts late in the month.

Rhubarb and asparagus beds should be cultivated and manured. Where drainage is good and conditions are warm enough to enable the plants to respond liquid manure can be applied to soil needing fertiliser.

If soil conditions permit, the ground can be prepared for new beds of rhubarb or asparagus. Deep digging is desirable on most heavy or fine-grained soil, as it improves drainage and aeration, which are especially important in the production of early vegetables.

Plans can be made for the forthcoming season's crops, special consideration being given to ensuring that each crop is succeeded by one of another family. Plans should ensure, too, that as far as possible gluts are avoided and plants appropriate to the



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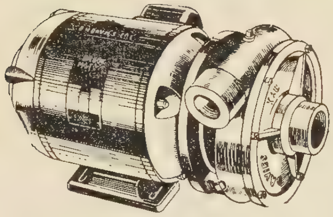

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capacity of the garden are available throughout the year. Only the varieties most suited to the district, soil, and climate should be used.

Broad Beans

It is not too late to sow broad beans. If a first sowing was made in autumn, a sowing made now will provide a succession for families who are fond of these beans. They do not need special soil, but it is not advisable to sow them in light soils which tend to dry out. They do well in fairly heavy, well drained soil that has been well cultivated and into which has been dug a moderate amount of organic matter such as compost or well rotted farmyard manure.

Heavy soil should be dug deeply, preferably some time before sowing. Though a small amount of potash is often beneficial, particularly on light soils or where disease is troublesome, the principal nutrient required on most New Zealand soils is phosphate. A dressing of 2 to 4 oz of superphosphate per square yard usually gives good results. In addition a small amount of nitrogenous fertiliser such as sulphate of ammonia or dried blood may be advisable on old, well worked home garden soils that are lacking in organic matter and low in fertility.

Seed should be sown in double rows about 10 in. apart with the seed placed diagonally 4 to 6 in. apart and 2 in. deep in the bottom of a shallow trench or drill 3 in. deep. Germination is usually good.

The main types are represented by varieties such as Broad Windsor and Mammoth Long Pod, but dwarf types having smaller beans (for example, The Sutton) are also available and are useful in exposed situations.

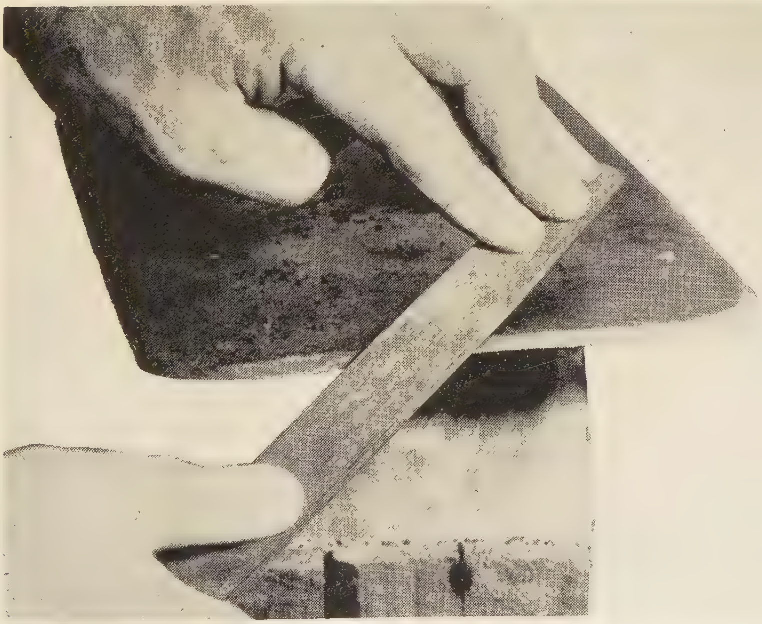
Cabbages and Cauliflowers

Those who prefer to grow their own cabbage and cauliflower seedlings can now sow quick-maturing varieties such as Golden Acre cabbage and All Seasons cauliflower. A warm, sheltered situation with favourable soil conditions is necessary. Where these conditions are lacking it is advisable to use cloches or a cold frame or well ventilated glasshouse.

If a suitable bed is not available, seed can be sown in boxes filled to a depth of 4 to 5 in. with light, open-textured soil, so that when the plants are sufficiently developed they can be removed from under the glass and hardened off. This method is not, however, conducive to the production of good plants unless the plants are pricked off very early.

Conditions should encourage rapid germination and growth. Plants if crowded should be thinned whether under glass or outdoors, as the desired type of seedling for transplanting is one with well developed roots and strong, rather stocky stem and leaf growth. Cauliflower plants are likely to fail if they receive a check from dryness, severe frost, cold wind, or injury during transplanting.

Sharpening a Spade



[Orr

The full length of the file face should be used in each stroke when sharpening garden tools. The file should be held flat on the bevelled edge and in each stroke should traverse the bevelled edge as far as possible.

Spring Cabbages

In poorer soils established crops of spring cabbages should be encouraged to make strong, quick growth by regular applications of liquid manure. If organic liquid manure is not available, sulphate of ammonia or nitrate of soda at 2 oz to 4 gallons of water can be applied.

Spring or pointed-type cabbage can still be set out in July, and this practice is favoured by some growers in districts where the winters are severe and the land tends to lie cold and wet. If well grown seedlings are planted out in richly manured, well drained soil, the plants mature very quickly.

Shallots

Its name dissociates the shallot in the minds of many from other members of the onion family and often prejudices its use in place of the onion. However, apart from its characteristic habit of growth, the shallot is readily confused by most people with smaller specimens of many varieties of onion, and the less common varieties of onion such as the multiplier or potato onion are occasionally grown under the misapprehension that they are shallots, some varieties of which are similar to multiplier onions.

The shallot is a hardy perennial which as it grows sends up numerous fine, hollow, awl-shaped leaves 8 to 15 in. long. It seldom produces seed and is usually perpetuated by replanting bulbs or offsets, which are produced in clusters on the soil surface.

There are several selections or varieties of shallots and they differ in size and colour of bulb, but the commonest type has a bulb about the thickness of a walnut or a little thicker, pear shaped, about 2 in. long, narrowing in the upper part into a fairly long point and enclosed in a tough skin, which is russet-coloured and often coppery red toward the base. The skin is usually wrinkled lengthwise. Under the outer skin the bulb is greenish at the base, shading to grey or even purple at the top.

Among the larger kinds of shallots which have been much improved by selection are those known as the Russian shallot (also known as Large Brown or Large Red) and the Jersey shallot, the bulbs of which may grow up to 2 in. in diameter and weigh several ounces. Named varieties of shallot are not generally available in New Zealand and obtaining the better varieties is usually a matter of luck or selection.

Soil and Manure

Shallots succeed in almost any garden soil, but prefer a well drained, fertile soil rich in well rotted organic matter. Heavy clay soils that dry out excessively or are poorly drained are least likely to give good results.

Manurial requirements are moderate and shallots do well on soils that were heavily manured for a previous crop. Where additional fertiliser is needed a dressing made, for example, of equal parts of blood and bone and superphosphate applied at 2 to 4 oz to the square yard according to the fertility of the soil is likely to give good results.

In districts of average to high rainfall growth on most soils not recently limed is likely to be improved by application of carbonate of lime at 3 to 4 oz to the square yard. Preferably, lime should be well worked in some time before planting. To avoid a build-up of disease, shallots should not be planted in a plot on which other members of the onion family have just been grown.

Planting

The home gardener is usually advised to plant shallots on the shortest day and harvest them on the longest, but they can be planted any time from late autumn until early spring when conditions are favourable. The keeping quality of different varieties varies. Some start growing much earlier than others and should be planted before they exhaust themselves producing leaves, though usually under good conditions even specimens that have become very wizened will produce a good crop.

Soil should be cultivated to a fine tilth, firmed, the rows marked or drills drawn, and the bulbs or cloves, graded to size, pressed far enough into the ground (usually ½ in.) to stabilise them, though deeper planting, even up to the neck, is sometimes preferred. Bulbs should be set 5 to 8 in. apart, according to the vigour of the variety, in rows not less than 12 in. apart. They soon develop roots and as they grow divide into a number of cloves or offsets which remain attached at the bases.

There is little advantage in planting large bulbs unless a great number of small cloves are wanted. Medium to small, though not excessively small, bulbs do not generally yield as heavily as large bulbs, but they usually yield more large bulbs.

Shallots can be grown from seed sown in spring as onions are, but seed is not generally listed in local catalogues, though it is listed in some from overseas.

After establishment shallots should need no attention other than weeding and cultivation if the soil becomes compacted and aeration is restricted.

Garlic

Garlic can also be planted in July or August. In general its culture is similar to that of shallots.

◆

200 Farm Tractor Fatalities in 10 Years

TWENTY-FOUR fatalities with farm tractors last year have now brought the total since January 1949, when the Department of Agriculture records were begun, to 200. Of these 22 deaths have been of children under 15.

TWO popular beliefs which the Department's records of fatalities do not substantiate are that dangers are associated mainly with the operation of wheeled tractors and that most fatal accidents occur when tractors are being operated on steep country. A quarter of the 200 fatalities have occurred with crawler tractors and many of the mishaps on relatively flat country. A feature has been that half the persons killed were struck or pinned by tractors that rolled over.

Danger from Undulations

A serious fault among tractor drivers that is persisting is failure to appreciate the serious danger from sharp undulations, ridges, or ditches in otherwise perfectly safe, flat areas. Hazards of this type and momentary relaxation of vigilance have led to many fatalities in recent years.

An isolated danger spot in an otherwise safe area caused the death of a child last year. He was riding on a tractor driven by his 12-year-old brother while the father was feeding out from the trailer towed by the tractor. The paddock was flat except for one uneven patch. When the tractor went into this the lurching caused the little boy to fall off and he was run over and killed.

This accident also underlines two other sources of fatalities about which the Department of Agriculture has issued warnings: That under no circumstances should children be allowed to ride on tractors, and that boys who may appear quite capable tractor drivers cannot because of their lack of strength and maturity be expected to cope with an emergency.

High Hitching of Loads

High hitching of loads or towing ropes in contravention of makers' recommendations appears to be another unwarranted risk to which operators expose themselves. A hitch should never be taken other than from the standard drawbar.

Those who have made a study of tractor accidents tend to wonder if operators are prepared to learn from the mistakes—often fatal—of others. The pattern in fatalities last year followed closely that of previous years. Some consolation can be taken from the fact, however, that though more tractors were being used on farms, fatalities dropped from 33 in the previous year to 24. Nevertheless an annual toll (based on experience in the past 10 years) of 20 deaths emphasises the need for unremitting attention to the job in hand at all times.

☆

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during February 1959 and for the 7 months ended 28 February 1959 with comparative figures for the same month and the 7 months of 1957-58 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage inc. or dec.
February 1959	16,678	285	16,963	—
February 1958	14,560	299	14,859	—
Increase or decrease	+2,118	—14	+2,104	+14.160
7 months ended 28/2/59	145,966	2.112	148,078	—
7 months ended 28/2/58	141,936	2,251	144,187	—
Increase or decrease	+4,030	—139	+3,891	+2.698

Butter in store at 28 February 1959 was 31,773 tons

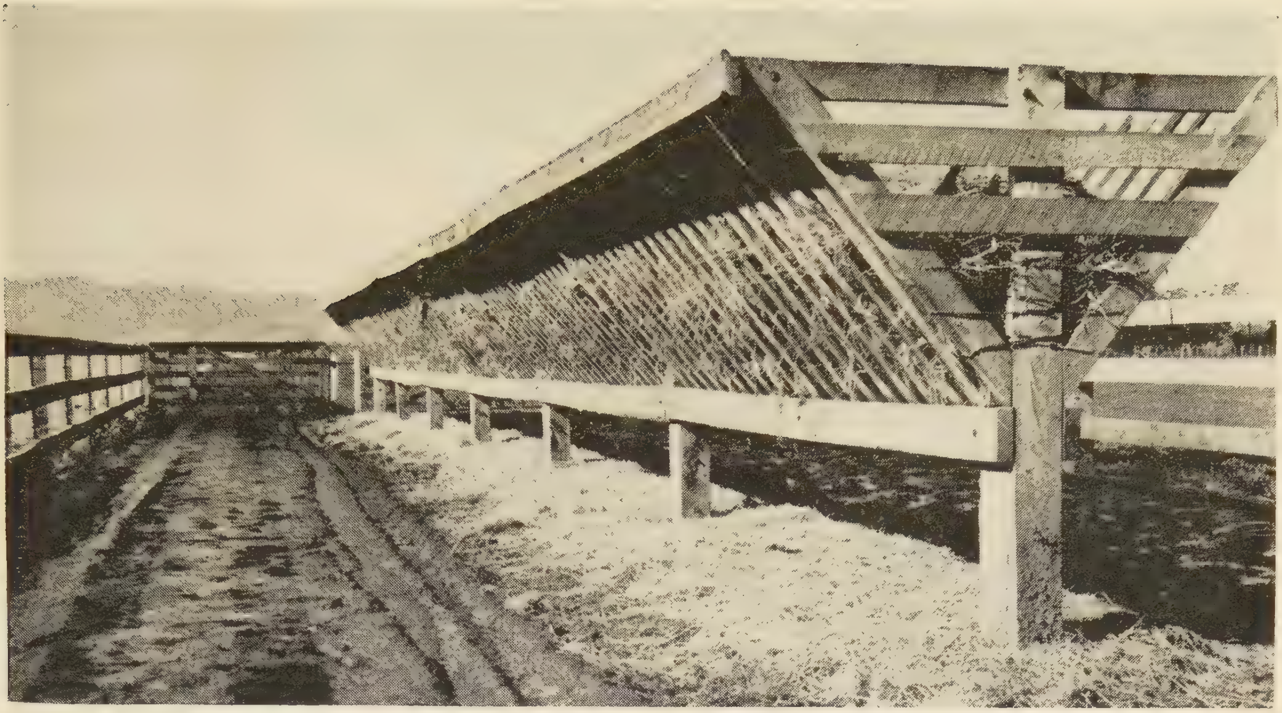
CHEESE

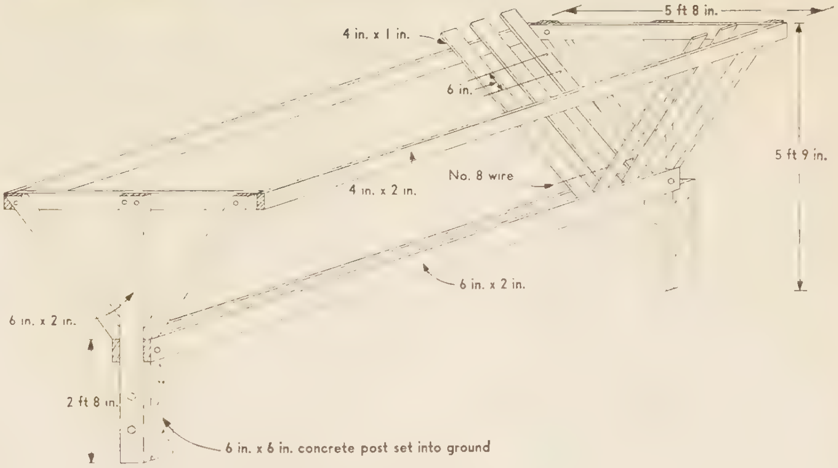
Period	White (tons)	Coloured (tons)	Total (tons)	Percentage inc. or dec.
February 1959	6,587	1,714	8,301	—
February 1958	7,740	1,437	9,177	—
Increase or decrease	—1,153	+277	—876	—9.545
7 months ended 28/2/59	48,386	11,875	60,261	—
7 months ended 28/2/58	59,686	10,297	69,983	—
Increase or decrease	—11,300	+1,578	—9,722	—13.891

Cheese in store at 28 February 1959 was 17,421 tons

If these figures are converted into butterfat equivalent, there is a decrease of 0.278 per cent in butterfat graded for the 7 months as compared with the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place they are not necessarily a true indication of production trends.

Use of Hay Feeding Racks on Dairy Farms





Upper—Double-sided rack set up on concreted portion of race 24 ft wide.
Lower—Construction details for section of rack.

By G. L. BANFIELD,
Instructor in Agriculture,
Department of Agriculture,
Thames

COMBATING mud and reducing poaching in late winter and spring is one of the biggest problems faced by dairy farmers on heavy soils. In this article the feeding of hay from racks set up near the cowshed is suggested as one way of alleviating the trouble.

ON the heavier poorly draining meadow soils it can be very difficult to feed out hay with the tractor or sledge during spring without cutting up tracks, gateways, and paddocks. The herd, milling round as the hay is put out, is also responsible for considerable pasture damage, while very much of the hay fed is lost through being tramped into the mud. Most damage occurs after the majority of the herd has calved, the cows then being concentrated to the maximum degree as relatively small areas are fed off in rotation. The position is further aggravated by the fact that the land in spring is usually wetter and softer than at any other time of the year.

Most of this can be avoided by the use of feeding racks placed in the race or in a special enclosure near the cowshed. As the cows pass through the shed they are able to get their fill of hay before returning to their next paddock. With a properly planned arrangement a hay barn is situated close to the feeding racks so that the tractor may not be needed at all for feeding out. Apart from the reduction in damage to the pastures and race, there is of course a considerable saving in time and fuel. The racks may be filled before the afternoon milking with enough hay to carry over for the morning milking.

The racks can be set up at the side or middle of the race or special enclosure so that stock have access to them from both sides at once. Excellent racks can be constructed from 1 in. galvanised piping and 6 in. heavy gauge mesh netting or from timber as shown in the diagram.

Provision of a bin made of heavy timber beneath the racks is worth while and serves two purposes. It

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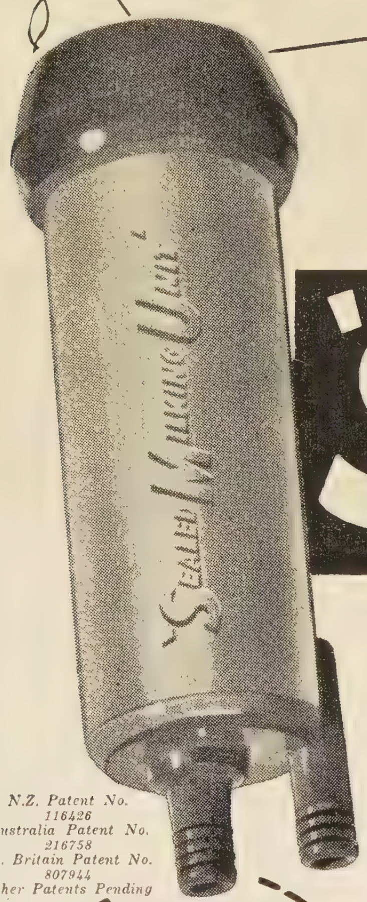

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Australia Patent No. 216758
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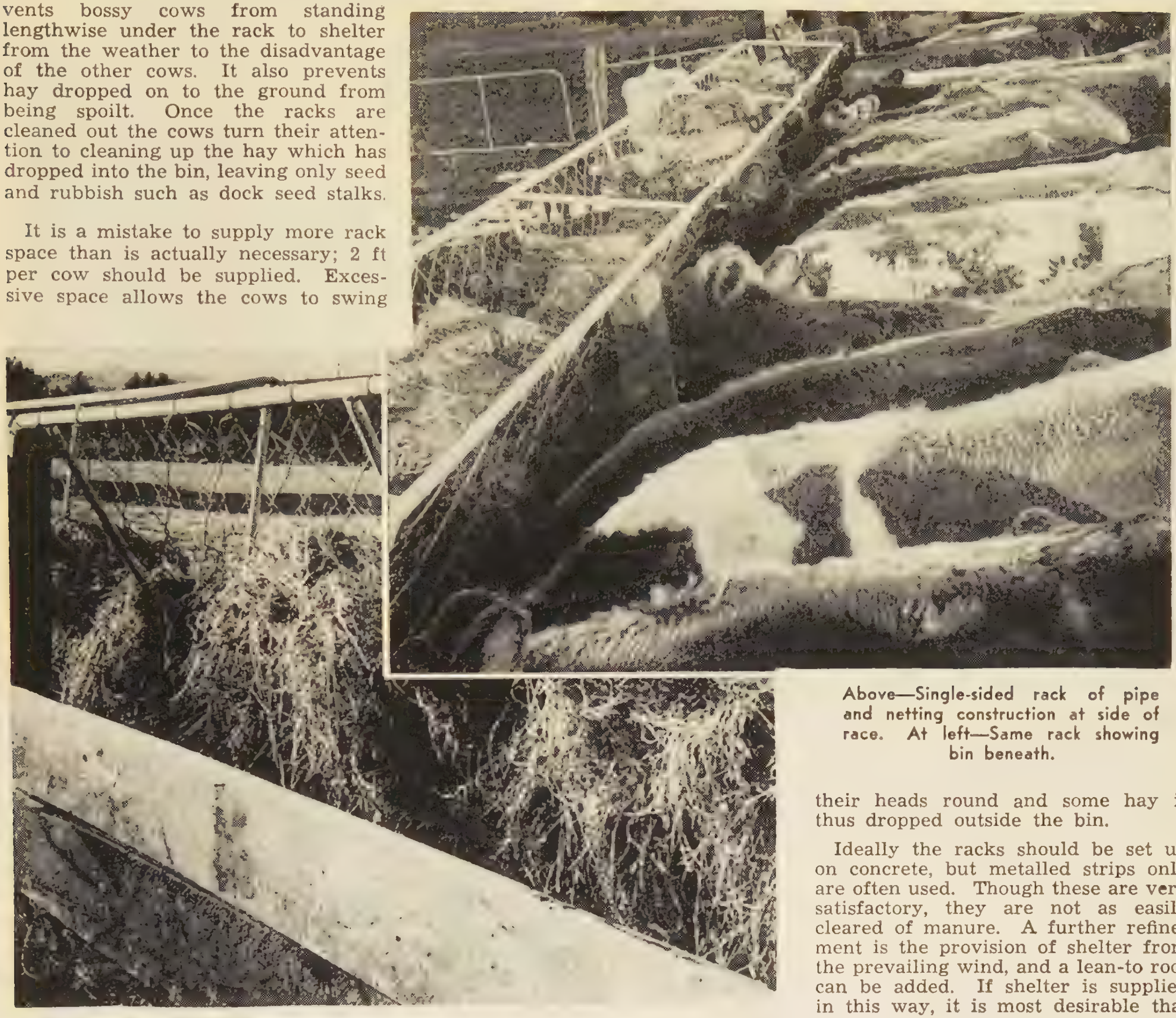
forces the cows to stand head toward the rack to reach the hay. This prevents bossy cows from standing lengthwise under the rack to shelter from the weather to the disadvantage of the other cows. It also prevents hay dropped on to the ground from being spoilt. Once the racks are cleaned out the cows turn their attention to cleaning up the hay which has dropped into the bin, leaving only seed and rubbish such as dock seed stalks.

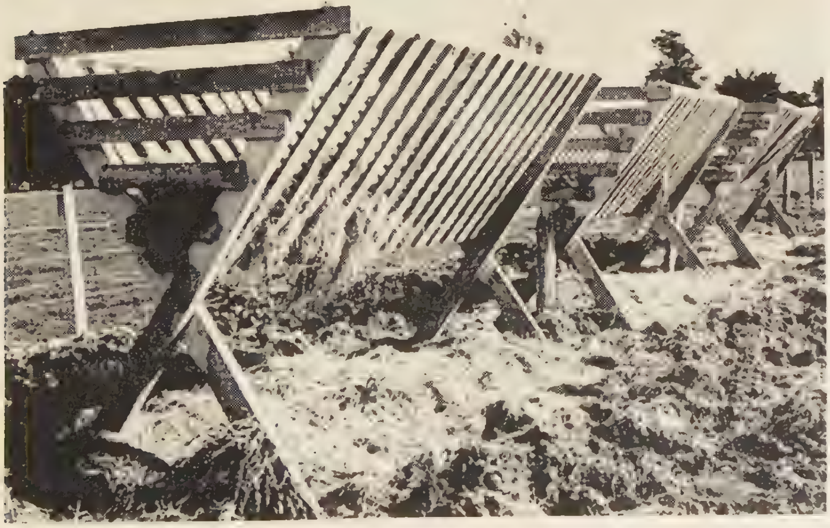
It is a mistake to supply more rack space than is actually necessary; 2 ft per cow should be supplied. Excessive space allows the cows to swing their heads round and some hay is thus dropped outside the bin.



Above—Single-sided rack of pipe and netting construction at side of race. At left—Same rack showing bin beneath.

Ideally the racks should be set up on concrete, but metalled strips only are often used. Though these are very satisfactory, they are not as easily cleared of manure. A further refinement is the provision of shelter from the prevailing wind, and a lean-to roof can be added. If shelter is supplied in this way, it is most desirable that it be left open to the sun on the north side.

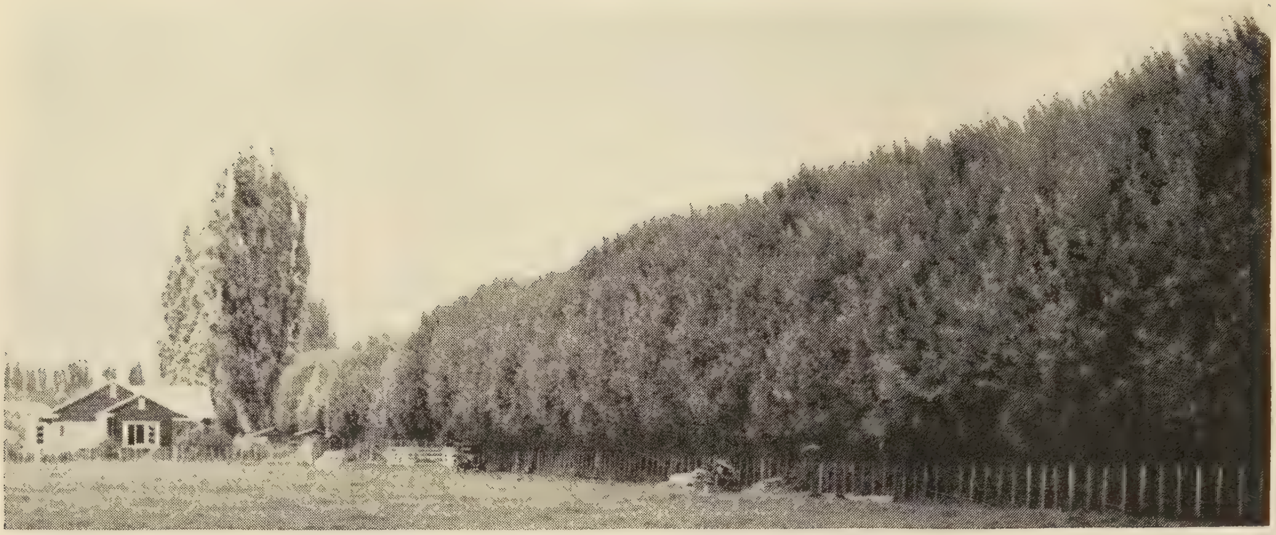
The main disadvantage of rack feeding of hay is that much of the manure which normally would automatically be spread in the paddocks has to be carted out by the farmer. This disadvantage is outweighed many times, however, by reduced damage to the pastures.



← Movable hay racks on metalled enclosure.

As the fertility of our dairy land increases it becomes less stable and so more prone to mud problems and poaching. On farms which are already faced with such a problem the provision of hay racks is considered extremely worth while.

Pussy Willow for Orchard Shelter



[R. W. Orr

A 12-year-old pussy willow belt about 35 ft high. The trees were planted 6 ft apart.

By T. CONWAY,
Instructor in Horticulture, Department of Agriculture, Hastings

IN districts where tall trees such as Lombardy poplars and *Pinus* species are used as orchard shelter maintenance is a recurring and costly item. In this article the author suggests that *Salix caprea* (one of the pussy willows) has merits which make it worthy of a trial by orchardists.

A DECIDUOUS shelter tree such as the Lombardy poplar has advantages over the evergreen types in that it allows more sun and air to penetrate through to the orchard during winter and allows a reasonable movement of air during summer. Furthermore, it grows very tall and provides excellent shelter if planted on the side of the orchard exposed to the prevailing wind.

Often, however, poplars are planted on three and sometimes four boundaries of the orchards, as well as for intermediate belts on larger orchards. Not only does this create too much shade and interference with the growth of nearby rows of fruit trees, but the maintenance of these belts is apt to be a laborious, recurring, and costly item. These factors could be greatly lessened if fruitgrowers could use a naturally lower growing deciduous species such as *Salix caprea*, except perhaps on the side of the orchards exposed to prevailing winds.

Suitability of Pussy Willow

Evidence from Hawke's Bay of the performance of these willows as farm shelter indicates that this species could well be grown by fruitgrowers.

One shelter belt of *Salix caprea* which has been under observation is considered to be almost ideal as an orchard shelter. At 12 years old it is over 35 ft high, which is probably near the maximum height to which it will grow.

The trees are spaced 6 ft apart with interplants of *Eleagnus*. As the habit of the pussy willow is to branch fairly close to the ground, there does not appear to be any real need for the *Eleagnus* to assure denseness near the base of the belt.

This belt of trees is upright and only moderately spreading, and there is no evidence of suckering. It loses its foliage fairly late in the season and breaks into growth earlier in spring than do most other trees.

The pussy willow is tolerant of a wide range of soil conditions, and it will sucker only if planted on swamp areas or on river banks. In orchard areas of moderate rainfall like Hawke's Bay there should be little risk from sucker development, especially if some care is taken to avoid damage to roots by cultivating implements.

For orchard shelter these pussy willows could be left to grow naturally without any topping or side trimming. If cutting or trimming is preferred, there is probably no tree which will recover so well. It has a very firm root anchorage and is able to withstand the heaviest winds.

Shelter belts can be easily established by planting cuttings, usually in late autumn with material from selected, good-type trees. The cuttings should be of ¾ to 1½ in. wood about 2 ft long. The heavier cuttings can be driven into the soil with a sledgehammer after slight pointing, and the lighter ones can be planted firmly with a spade. Depth of planting should be about three-quarters the length of the cutting. Spacing of the cuttings is not critical, as the plants soon adjust themselves to the spacing allowed, but a 4 to 6 ft spacing should provide the highest and best type of shelter for orchards.

Growth is fairly rapid and in three years a belt can be expected to reach a height of 10 to 12 ft.

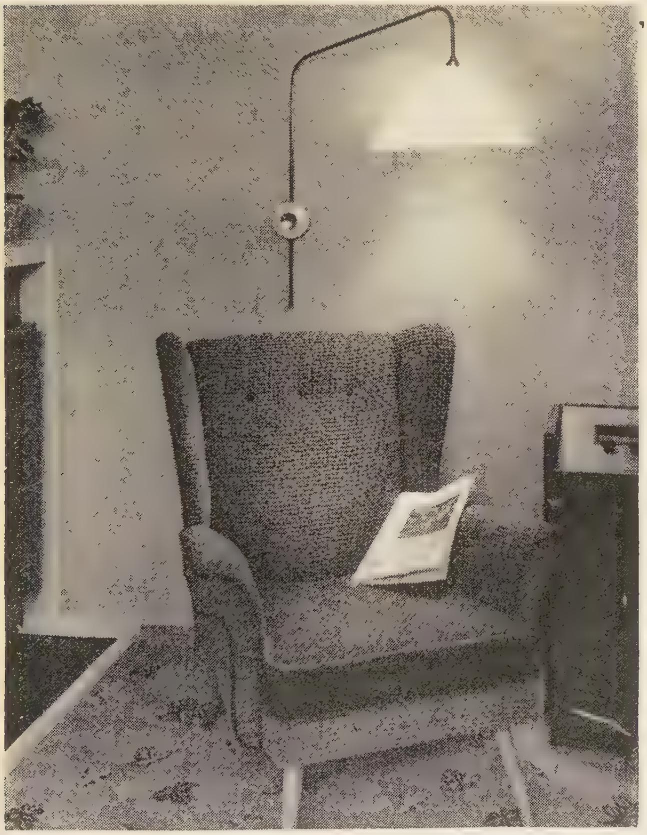
Some Pussy Willows Noxious Weeds

Some of the pussy willows are declared noxious weeds in some counties and a check should be made with the local authority to ensure that safe species are planted.

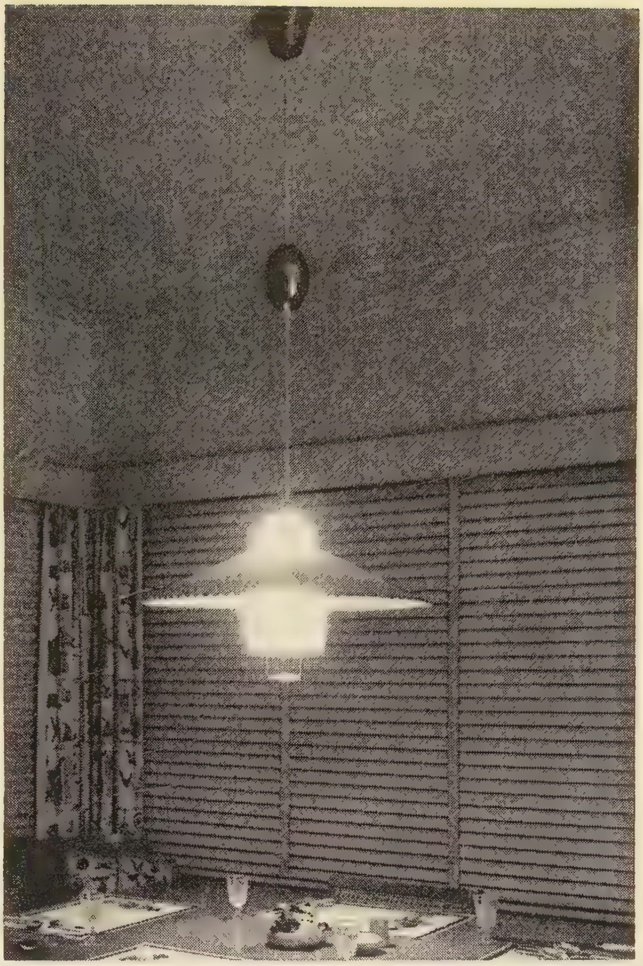
Lighting in the home was
discussed in general terms
last month by CHRISTINE LYONS,
formerly Home Science Instructor,
Department of Agriculture,
Auckland. She now deals with

Lighting Room by Room

WITH the attractive light fittings available today, lighting plays an important part in interior decoration. Basically, lighting must be good in quality and sufficient in quantity, but the atmosphere of a room at night depends very largely on the method of lighting. Lights in rooms should have a purpose and the lighting should be adaptable (or flexible). In other words, it should be able to provide sufficient light for a wide range of activities, though that does not mean that all the lights in a room need be used at the same time or any of them all the time.



An excellent fitting for localised light. The lamp is attached to the wall, but can be moved up or down and to left or right by adjusting the round fitting just above the chair.



The centre light over this dining table can be raised or lowered to any height desired by the handle at the bottom of the fitting.

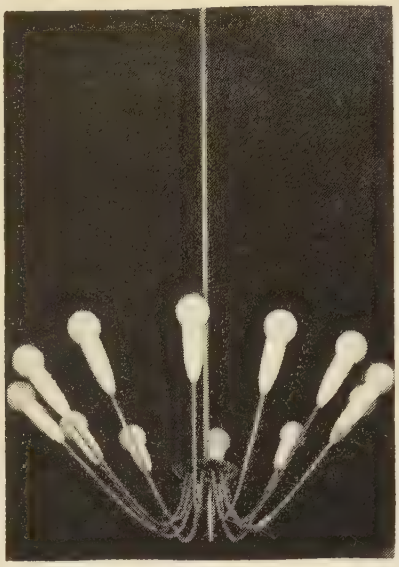
ALL rooms need general lighting. General lighting is the main source of light and should not be confused with localised or additional light, which is provided by portable table and standard lamps or by wall brackets. Generalised lighting is usually supplied from a ceiling fixture, and for accepted good lighting it is supplemented by lamps scattered round the room which can be used at will for activities requiring more light.

Eyesight is very precious and, unfortunately, many homes are insufficiently lit. Often a 100-watt incandescent bulb (or equivalent fluorescent tube) is being used when 150 watts are needed. Over a period of years this will cause considerable eyestrain, which will be felt later.

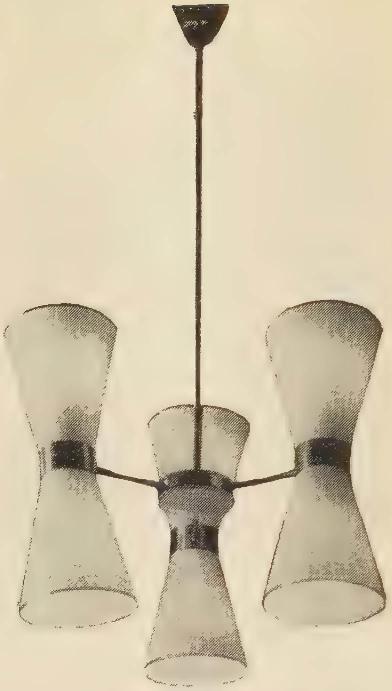
To estimate the amount of light that is needed **for general lighting** allow 1 watt per square foot of floor space. Thus, if a room is 15 x 10 ft, a 150-watt incandescent or equivalent fluorescent bulb is needed. If there are dark-coloured walls or ceilings or a lot of dark furnishings, more light will be needed. The formula is a minimum requirement for a light-coloured room and should be supplemented by additional localised lighting. If the room is large, two general fixtures or a chandelier type will be needed, as the largest domestic incandescent bulb available is 200 watts.

LIGHT FITTINGS FOR VARIOUS PURPOSES

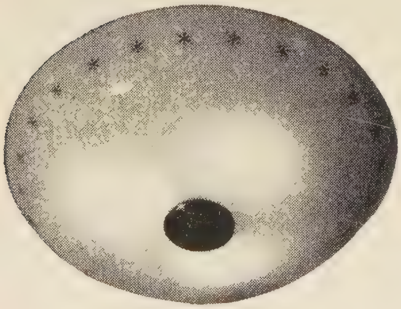
Shade made from plastic film sprayed over a wire frame. It gives an efficient diffused light. The shade can be washed with warm soapy water.



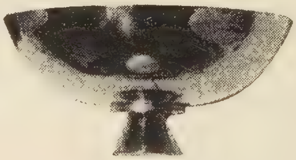
Contemporary chandelier-type fitting which uses 25- or 40-watt silica bulbs.



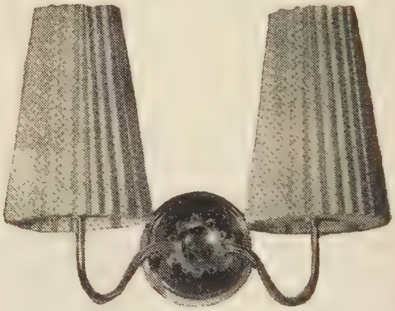
Colourful contemporary fitting with six bulbs, three giving direct light and three indirect light.



Semi-direct fitting which sends most of the light upward. The bowl hangs on a wooden shaft about 8 in. from the ceiling.



Wall bracket which gives indirect light.



Wall bracket with pleated fabric shades.

This fitting is ideal for use in a steamy atmosphere such as in a bathroom or laundry. It is also a good outside fitting, being completely moth and fly proof.

Table lamp which conforms to all aspects of good design. The shaft is wooden and the base is brass.

Decorative outside fitting for a wall mount.

Wattage being used should be checked by the formula given for general lighting. If the calculation shows the lighting to be deficient, this can usually be corrected by replacing bulbs with ones of higher wattage. Sometimes, however, it may be necessary to replace the fitting to accommodate a larger bulb. This is a good opportunity to discard older and less efficient fittings.

Interior Decoration Aspects

Using direct lighting (when the light is directed downward) will give the impression of lowering the ceiling; thus, in a very high room, this effect may be used to advantage. Wall brackets, which are often used in a modern home as a source of general lighting, will also create this effect, provided they are placed approximately 5 ft 6 in. from the floor. These brackets will at the same time give the effect of spaciousness—of widening the room.

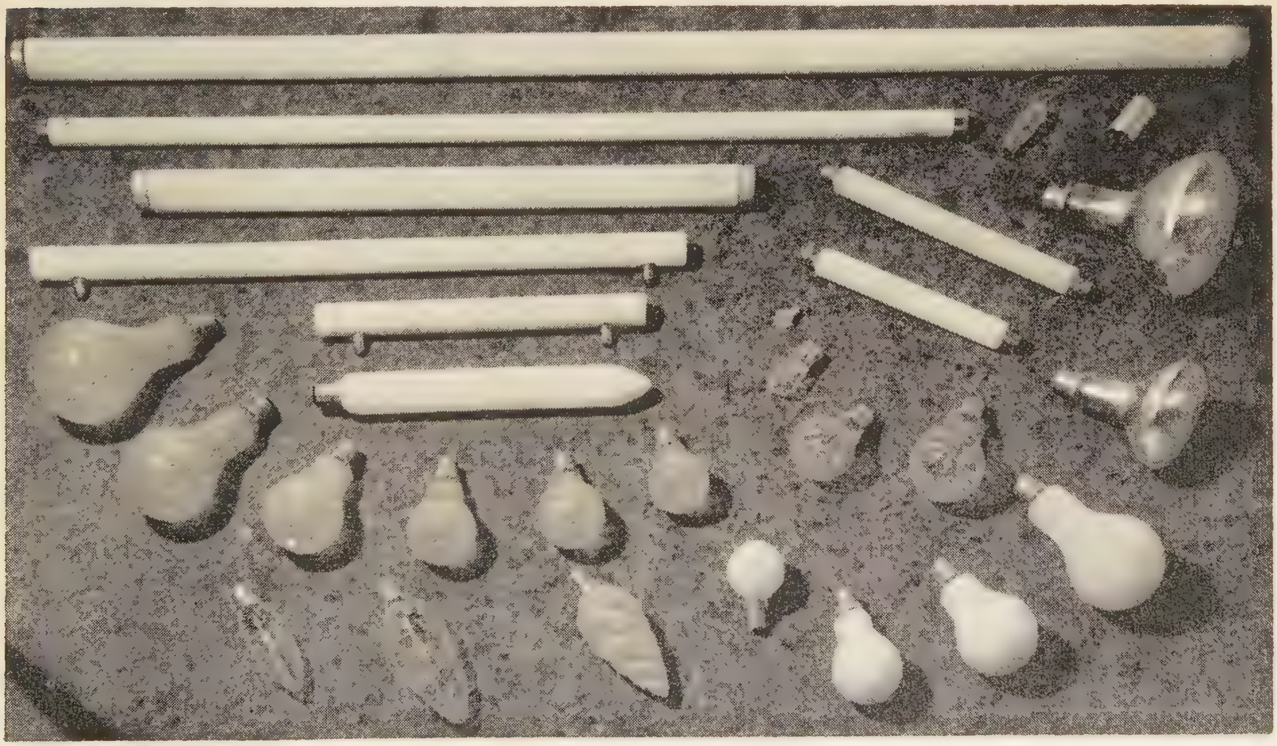
Portable lamps are an essential feature of good and attractive lighting. They will, however, need to harmonise with other furniture and furnishings and the lamp shades should be in good proportion and balance. If a lamp is too low to be practicable, it may be improved by standing it on a base or on a taller piece of furniture. If this is done, the shade may have to be enlarged to keep the proportion. The amount of light available will be much better if the shades are wide and flaring, and for the greatest light reflection the inside of the shade should be white or pastel coloured.

There are times, however, when lamps are used purely for decoration. They may then be a dark colour or of a shape that does not allow good light. A low-powered bulb can also be used.

Lighting a particular wall or object can often be done with great effect if the light is concealed. Fluorescent lighting is excellent for this, as the tubes do not get hot, but strip lighting can also be used. This concealed lighting can be used under pelmets, in wall recesses, or even in china cabinets, if there is a particularly beautiful piece which is worthy of prominent display.

Dramatic effect obtained by strip lighting placed at the top of an alcove. As well as highlighting the ornaments it shows up to perfection the cherry colour of the walls and the white of the shelves.

▼ The range of bulbs and tubes which is available for various fittings.



Take steps ...
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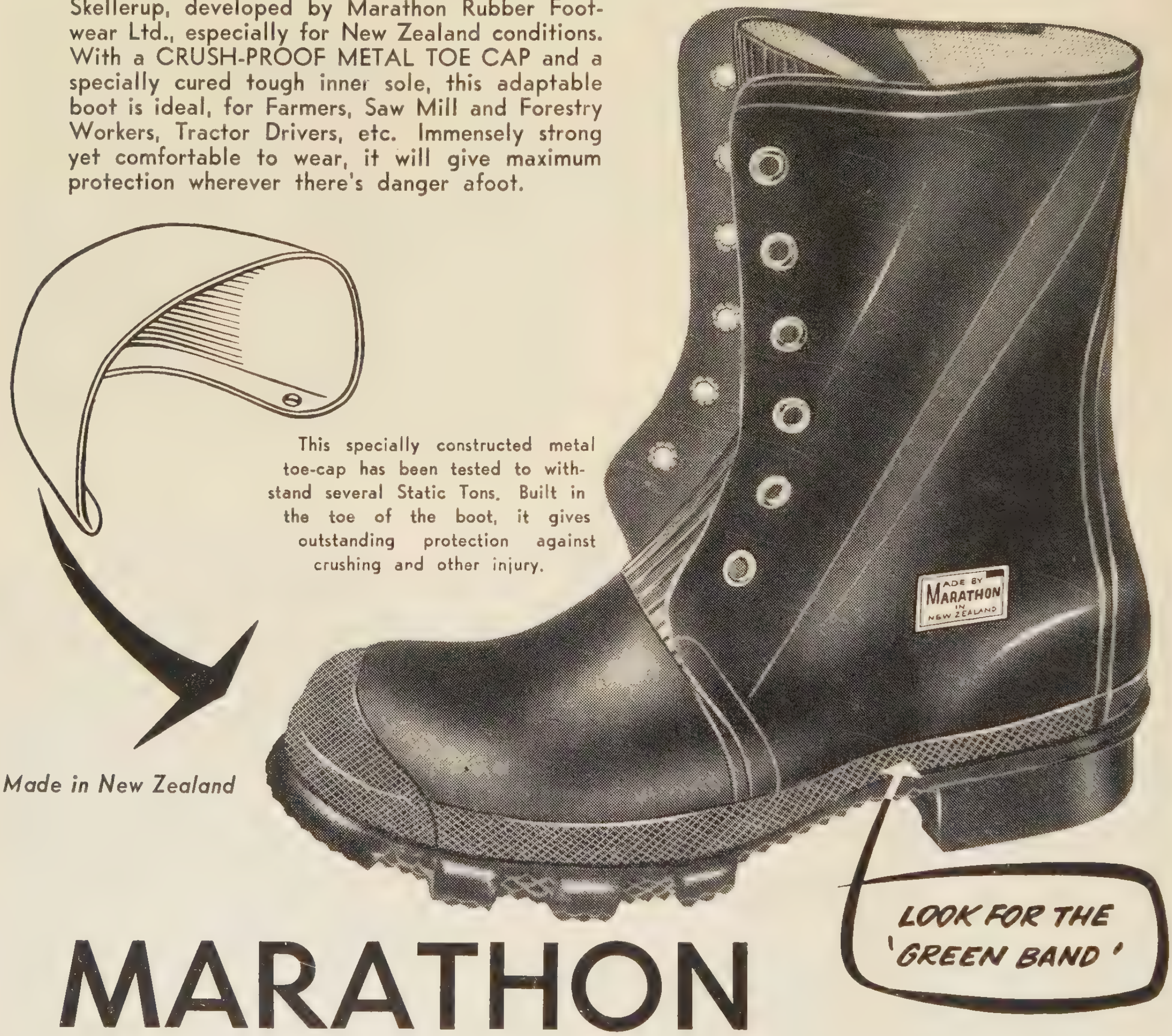
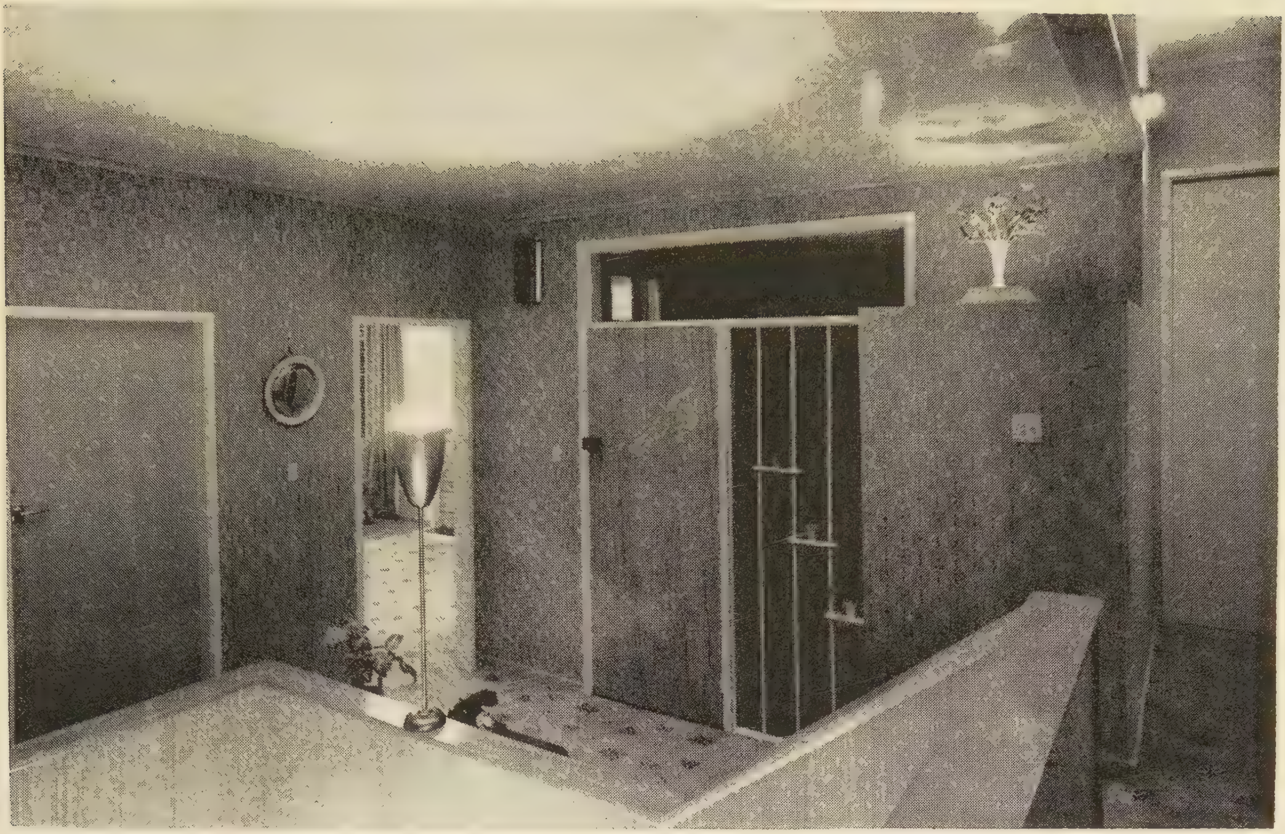
Here's a Gumboot that is essential to the safety of farmers and all outdoor workers. It's the MARATHON "Safety Toe" Ankle Boot by Skellerup, developed by Marathon Rubber Footwear Ltd., especially for New Zealand conditions. With a CRUSH-PROOF METAL TOE CAP and a specially cured tough inner sole, this adaptable boot is ideal, for Farmers, Saw Mill and Forestry Workers, Tractor Drivers, etc. Immensely strong yet comfortable to wear, it will give maximum protection wherever there's danger afoot.



This specially constructed metal toe-cap has been tested to withstand several Static Tons. Built in the toe of the boot, it gives outstanding protection against crushing and other injury.

Made in New Zealand

MARATHON
SAFETY TOE Ankle Boot
By Skellerup



Novel effects can be achieved by well planned lighting. This hall is lit in three ways. 1—The standard lamp on the stair rail highlights a panelled ceiling. 2—Strip lights are used in the hall of the bedroom wing (right). 3—A decorative plinth light on top of the coat cupboard illuminates a vase of flowers.

If the overall furnishings of a room are to be coordinated, lamp fittings and shades should be of a similar style and colour. If the aim is to "divide" the room into areas, lamps and lamp shades of different designs should be used. Remember when choosing lamps that they are going to be very conspicuous and their selection will therefore warrant considerable care. As with most things, they are much more effective if simple in shape and design.

Living Room

Most families spend a lot of both leisure and working time in their living room. The lighting here should be restful and flexible, and this will be best accomplished by a good source of general lighting together with localised lighting for working and reading areas. (If table or standard lamps or wall brackets are well placed, they can provide localised lighting for two or even more people.)

Localised lighting, such as table or standard lamps, with the general lighting of 1 watt per square foot of floor space for a light-toned room and perhaps a wall fitting or a concealed light fitting, should provide sufficient lighting for an average-sized family. Localised lighting is more practical if placed toward the walls of the living room. It has the effect of making the room appear larger and at the same time emphasises items of furniture.

The need for enough lighting in the living room cannot be too strongly emphasised. Admittedly, extra and more powerful lamps will increase the lighting bill, but only by a very small proportion, and who would really want to save a few shillings per year at the risk of poor eyesight in the years to come? A 100-watt lamp uses 1 unit of electricity in 10 hours. The average cost of a unit throughout New Zealand is 1d. To run a 1-bar electric heater for 10 hours costs 10 times as much.

Dining Room

General lighting, plus a light over the table, is preferable for the dining room. If the room is very small, however, the light over the table could be the general light. If possible, have a light fitting that can be raised or lowered over the table, as it will be found extremely useful if the table is being used for dressmaking, homework, or writing. If the dining room and living room are combined, the use of completely different light fittings for the dining area can help to "divide" the room.

Bedrooms

Bedrooms should have soft, diffused general lighting and additional reading lamps for each bedhead and another light by the dressing table mirror. This mirror light should be placed at the side and not hung from the ceiling; the best arrangement is to have two incandescent tubular (strip) lamps, one on each side of the mirror. The bedside lamps should be approximately 60 watts, but they must be placed so that they do not cast shadows on a book while it is being read.

A light in a deep wardrobe or, for that matter, in a deep cupboard is a tremendous help. This can be arranged quite simply by an automatic switch attached to the door which works on the same principle as a refrigerator light. When the door is open the light is on, and vice versa.

Kitchen

Good lighting is very important in the kitchen. The housewife has to spend so much time in the kitchen and her work can be made consider-

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Shell White Spirit and Dry Cleaning Aids
Shelltox Fly Spray and Shelltox Aerosols
Shell Spraying Oils — certified by the Plant Diseases Division, D.S.I.R.
Shellestol "H" — a wetting and spreading agent for water-base sprays
Shell D.D. and C.B.P. Soil Fumigants
Shell Defiance Blowfly Oil
Aldrin, Dieldrin and Endrin Insecticides
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Epikote Resins
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Teepol
Shell Lighter and Cleaning Fluid
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Partners in new ideas

Until a few years ago, farmers who wished to spray their carrot crops were forced to use ordinary power kerosine for this purpose. Results were not always satisfactory because of variation of components within the power kerosine which did not affect the fuel but could cause burning and poor weed control on carrot crops.

The Shell Organisation was thus set the problem of developing a new selective weedkiller which would give full control of weeds without any adverse effect on carrots and parsnips and give this control under a wide range of climatic conditions. Field tests were carried out throughout New Zealand and after many tests the result was a blend of light aromatic oils, laboratory controlled to rigid specifications. This blend is known as "Shell Weedkiller W", which is applied undiluted to carrots and parsnips to control weeds in these crops. It does not sterilize the soil and does not cause tainting of the crop. It is widely used throughout New Zealand and gives excellent weed control.

The development and success of Shell Weedkiller W is yet another testimony to the knowledge and skill of Shell scientists and field research teams — partners in new ideas. Yet another reason why you can be sure of Shell.

Shell serves the man on the land

SHELL

THE SHELL COMPANY OF NEW ZEALAND LIMITED
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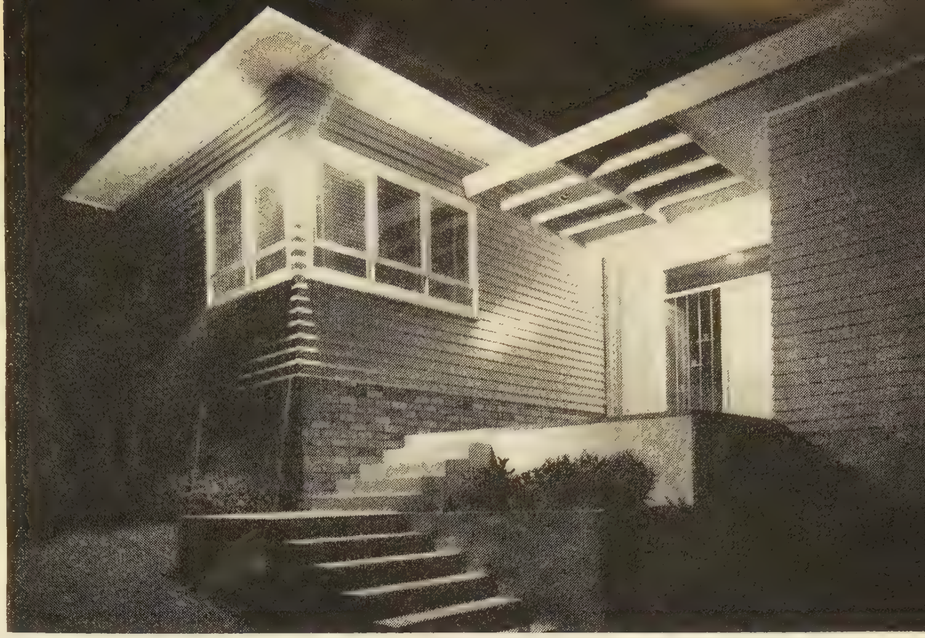
ably easier by well planned lighting. Lighting should be arranged to give adequate illumination to the various working areas, such as over the sink and by the stove. There should be no heavy shadows; fluorescent lighting is ideal.

Not commonly seen, but excellent, are foot switches at doorways. They are very convenient when the hands are full, for instance, when dishes are being carried from the dining room to the kitchen or when stores are being brought in from outside.


Adequate lighting is essential for both back and front steps leading to a house. Because there is a large area to be lit at the entrance of this house, two lamps have been used, one to light the steps and the other placed over the front door.

Bathroom

If the bathroom is large, it is of considerable advantage to have an additional light placed in relation to the mirror as suggested for the bedroom dressing table mirror. In a small bathroom the general light can be a wall fixture above the mirror. In this way, the light is placed where it is most needed.

A closed lamp fitting is an added advantage because it excludes steam, and if light fittings are constantly exposed to steam, dust will be held to a greater extent and this will decrease their efficiency.

Stairs

Stairs need illumination to the degree of providing a good contrast between the edge of each tread and the surface of the tread immediately below, but without causing glare to people going up or down. A lamp placed off-centre at the head of the stairs should make this possible, though having a lamp for the stairway and another for the landing is better.

The lights for the stairway should be controllable from two positions, one at the top and the other at the bottom of the stairs. Ill-lit stairs are one of the greatest causes of accidents.

Halls

Lighting in halls is often neglected with the result that the entrance to a house is very gloomy. Lights should illuminate the whole hall and convey a friendly atmosphere to people coming into a house. Some very attractive effects can be obtained with cleverly thought out hall lighting.

Front and Back Doors

Special lighting outside front and back doors is a necessity, especially when there is no other lighting such as from glass panels in or round the doors. Steps leading up to the doors must be well lit and if there is a name or number to the house, that can be lit up also. There are some very attractive outdoor fittings and a concealed outside switch is a great advantage. If the garage is close to the house, there could be a switch there which could control front or back door lighting. A time-lag switch is a further convenience.

Cleaning Electric Light Fittings

To get the best value from light, lamps and fittings need to be clean. Dust on bulbs and shades absorbs light and consequently these fittings should be dusted as regularly as furniture. Bulbs and fluorescent tubes should be cleaned when cold with a damp, soapy cloth. Never immerse the bulbs in water.

When bulbs or tubes darken they are no longer efficient and should be replaced.

The switch on the door jamb of this wardrobe operates in the same way as that on a refrigerator. When the door closes the light switches off.

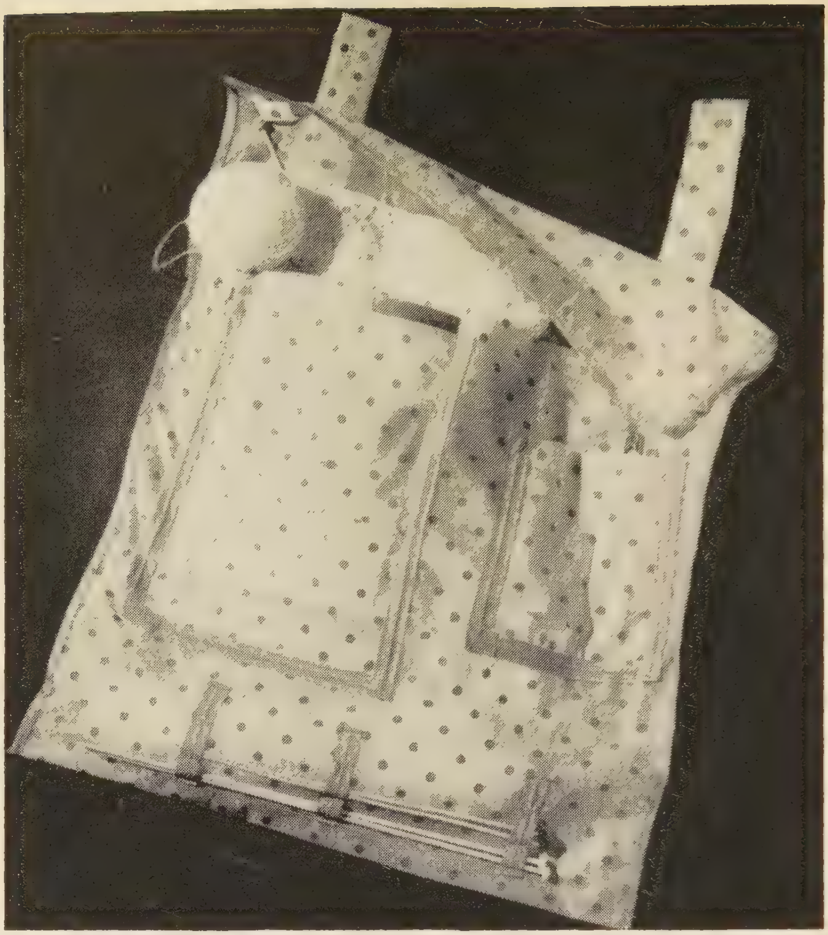
Photographs by Sparrow.

A Handy Knitting Bag

By ELEANOR S. CAMPBELL,
formerly Home Science Instructor,
Department of Agriculture,
Auckland

PLASTIC materials have many uses, not the least being their usefulness as holders or bags. The following pattern for a knitting bag is easy to make, the completed article being a most attractive and useful gift for any knitter.

MATERIALS required are: ¾ yd of 36 in.-wide plastic material; one card of bias binding, preferably nylon; one reel of mercerised cotton; two taped domes.

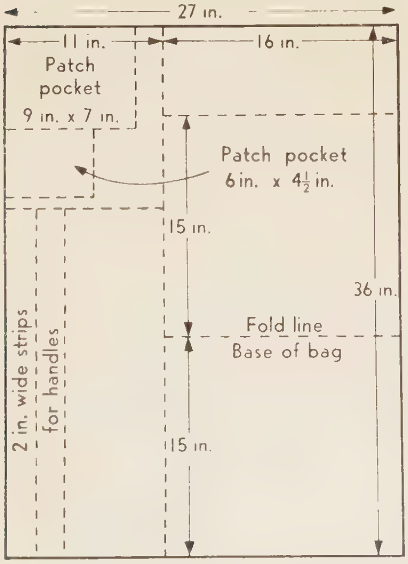


[*Sparrow*

To Make up

Lay the plastic out flat and cut a straight strip 11 in. wide down the longer side. This leaves two strips, one 11 in. x 36 in. and one 16 in. x 36 in. (see diagram below). The wider piece forms the bag itself, the narrower strip being used for pockets and handles.

From the narrower piece cut two rectangles, one large enough to hold a knitting book and one to hold a needle gauge or stitch holders. On the bag illustrated the large pocket was 9 in. x 7 in. and the small one 6 in. x 4½ in. From the remaining part of the narrower piece of plastic cut two 2 in.-wide strips to form the handles.



Pattern for cutting out the bag.

On the large piece of plastic (16 in. x 36 in.) measure up 15 in. from the bottom on each side and make a fold on this mark by bringing the lower edge up to form a bag. Do not sew yet. The other end of the plastic will extend 6 in. above the edge which has been brought up, and this will be turned down later to form a flap. On the outside front of the bag place the two patch pockets about 2 or 3 in. down from the top edge. Pin bias binding round the side and bottom edges of each pocket, leaving the tops free. Below the pockets and 2 in. up from the bottom of the bag pin three strips of tape or binding to hold needles (see illustration above).

Sewing

Unpin the front of the bag so that the plastic is in one straight piece with the patch pockets and tapes pinned into place. Machine round the pockets and across the ends of the tapes. Run two lines of stitching across the tapes, dividing them into three compartments, so that knitting needles can be pushed through and held in these pockets.

On each corner above the patch pockets and on the same side of the material sew one taped dome. Now turn the plastic over with the pockets underneath and fold up again at the 15 in. line, thus forming a bag with a flap. Pin the edges taped with bias binding and machine stitch down the two sides. Bind the edges of the free flap above, and at each corner sew on the other half of the taped domes.

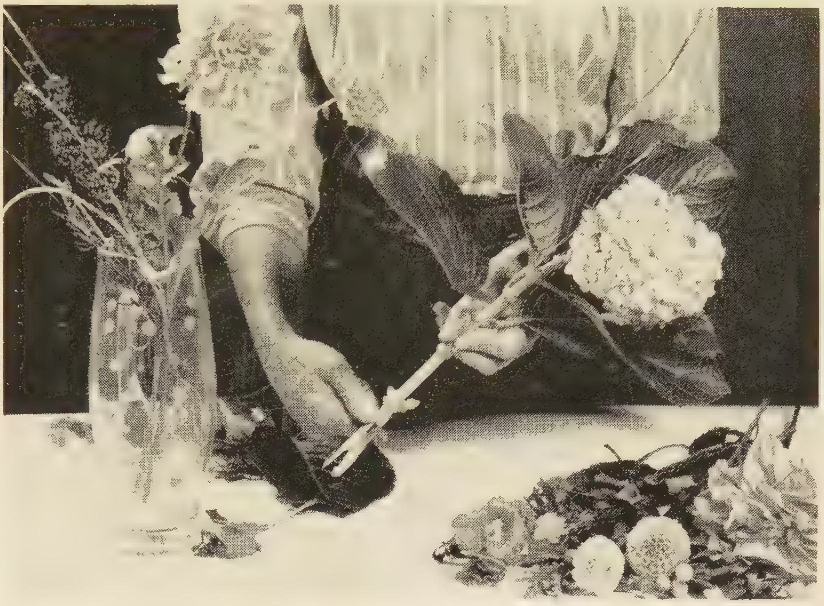
Take the two strips of plastic to be used as handles and bind the outside edges with bias binding or leave free as desired. Fold each strip over to form a handle and machine each handle on near the top of the bag (see illustration), one at each side and 1 in. in from the outside edges and 1 in. below where the top will fold over.

A smaller knitting bag can be just as easily made by following the same instructions but by making the length and width of the larger rectangle several inches shorter. The bag illustrated is fairly large, being about 16 in. x 18 in., but this size can be very simply reduced as desired.

Choice and Treatment of Cut Flowers and Foliage for Decoration

By JOY WATKINS,
Instructor in Horticulture,
Department of Agriculture,
Auckland

A VISIT to any exhibition of floral art will be sufficient to demonstrate the vast range of materials which can be used and the ingenuity of the artists in arranging them effectively. As a considerable amount of time and trouble is taken in assembling such decorations, it is desirable that they should last for a reasonable period, as few housewives have either the time or inclination to create new displays every day. Even if only one flower wilts, it can ruin the effect, and it is difficult to replace it without disturbing the whole arrangement; so it is well worth while taking the trouble to select suitable flowers and foliage from the garden and give them any necessary treatment to prolong their useful life.



[Sparrow

Normal treatment of flowers. Lower leaves should be removed and the stems placed in deep water. Woody stems should first be slit as shown to increase the surface through which water is absorbed.

EXPERIENCE will soon show which flowers and leaves last well when cut, but as a general guide flowers having firm petals, particularly if they are shiny or waxy, will live longer than those with delicate, thin petals; and leaves which are grey or glossy are preferable to those which are large and thin.

Choice of Foliage

Leaves which have a distinctive shape, such as flag iris, flax, begonia, hosta, canna, calla, and those of the house plants—sanseveria, peperomia, maranta, etc.—can be used for dramatic effects. Those in shades of grey, bronze, and red, or with pink, silver, or golden variegations are invaluable for more subtle colour blendings. There are many plants with coloured leaves, but a few of the best are:

Fuchsia gracilis elegans, which can be grown as a pot plant, or out of doors in mild areas, has pink variegations.

Phormium tenax purpurea (red-leafed flax), *Rhus cotinus folius purpureus*, red canna, and copper beech provide the warm shades of bronze which are so attractive with flame and apricot coloured flowers.

Senecio greyi, *Stachys lanata*, *Cineraria maritima*, eucalyptus, and leucadendron, the silver tree, are a few outstanding grey-leafed plants which are easily grown and propagated. They thrive in poor, dry soils and are of particular value when cut, as they tolerate hot, dry conditions in a room and last well under most conditions, blending with both rich and pastel colours.

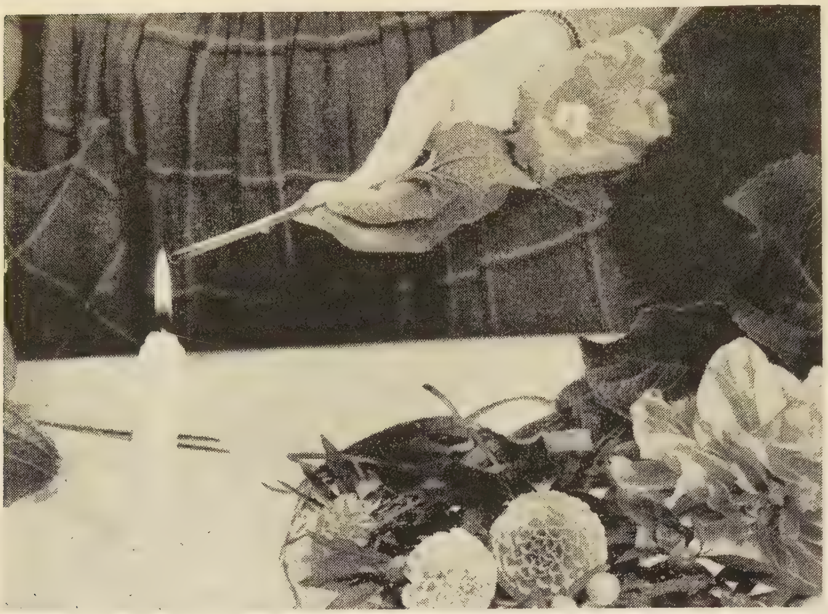
In the garden these foliage plants remain interesting throughout the year, whereas the majority of flowering plants are beautiful in their season, but rather drab afterward.

Treatment of Leaves

Individual leaves should be cut carefully from the plant with a sharp knife and placed immediately in cold water for four hours or more. If the leaves are large and delicate and therefore likely to wilt rapidly, such as those of ferns, they should be immersed completely for about an hour in cold water before the normal period of "hardening". In this way any leaf has a good supply of water in its tissues before it is placed in an arrangement.

The natural curve of a leaf can be a source of inspiration in the creation of a design, but if this is lacking, a pleasing curve or twist can be induced Firm leaves such as those of sanseveria can be gently shaped by manipulation with warm hands. Young leaves and those which have less substance can be rolled or twisted to the desired shape immediately after cutting and tied securely before being immersed completely in cold water for an hour This will "set" the shape, after which the leaf is placed with only its stalk in water and the tie cut when the leaf is dry again. Calla, hosta, canna, and aspidistra are a few which respond to this treatment.

Evergreen leaves such as those of pines, camellia, magnolia, and Mexican orange blossom are particularly valuable when flowers are scarce, but their beauty is often masked by an accumulated layer of dust and possibly of spray residues. Their appearance is vastly improved by washing the leaves and branches in warm soapy water and rinsing them thoroughly in cold water. A final polish with a cloth dipped in a little olive oil gives an added gloss, but this is not usually necessary.



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Stems which exude a milky sap when cut are soon sealed off by the coagulation of the "milk". To allow water to enter the stems the ends can be seared in a flame for 15 seconds.

Branches or sprays of leaves need a little extra attention to ensure that they can take up water. Before stems are placed in the container of water to harden they should be recut and the bases slit up 1 or 2 in. with a sharp knife to expose a greater surface for absorbing water.

Bare branches have a special place in line arrangements. Willow, silver birch, beech, and similar more angular types are desirable because of their asymmetry for the somewhat austere "modern" forms of floral art. Broom is invaluable, as it can be treated in the same way as leaves to induce the most beautiful curves.

When few flowers are available, or during the hottest part of the year when flowers will not last long, a basic arrangement of leaves or branches can form a background for a small group of flowers which can readily be replaced as necessary.

Choice of Flowers

Practically any garden flower can be used in some way, whether it is an annual, bulb, herbaceous perennial, or shrub. Extra bulbs and annuals for cut flowers can be grown in the vegetable garden. New varieties and hybrids are being introduced every year, many with superior lasting qualities to older types.

Apart from those which are very short lived when cut, such as poppies, water-lilies, and passionflowers, the only ones to avoid are those with a heavy scent, which becomes overpowering in a room, and those which shed quantities of pollen. This is not only unsightly but can stain fabrics and polished wood and is most undesirable for anyone who suffers from asthma or hay fever.

For a variety of arrangements there should be a variety of flowers, both in colour and shape. The latter is just as important to the floral artist as the colour, so there should be a selection of round and spiky flowers as well as a few of the more distinct types such as calla or cyclamen.

It is more rewarding to grow a large quantity of flowers which flourish without difficulty in the garden, with a few of the more unusual kinds to add interest, than to attempt to grow a very wide range of flowers and foliage plants which are not really suited to the soil and climate. With a little forethought it is possible to have some flowers or leaves to cut from any garden throughout the year.

When to Cut

The time of cutting flowers has a considerable effect on their lasting qualities. They should be cut in the cool of the day, preferably in the evening, as they are then well supplied with sugars made by the leaves during daylight.

The stage of development at which to cut depends on the individual species, though usually they should be in the advanced bud or nearly mature stage. If flowers are cut too young, the buds will often fail to open; if left until mature, flowers will rapidly deteriorate, shedding petals and losing freshness.

Flowers from bulbs or corms can be cut as soon as the flower is fully coloured and beginning to open. Cut a spike of flowers when the first flower on the spike is fully coloured and beginning to open.

Most other spike flowers should be left until as many as possible of the flowers on the spike are fully developed and open but before the first flower has begun to fade. Round, daisy-type flowers should be cut when the inner florets are just beginning to open, the outer ones being fully developed. Gerberas should not be cut for one or two days after being fully open, as otherwise the youngest part of the stems, immediately behind the flowers, are still soft and will lose their water, and flower heads will droop.

Several species of flowers will not develop if cut while still in bud, though they are sometimes useful in a design for this very reason. They include cyclamen, fuchsia, violets, and coral bells (heuchera).

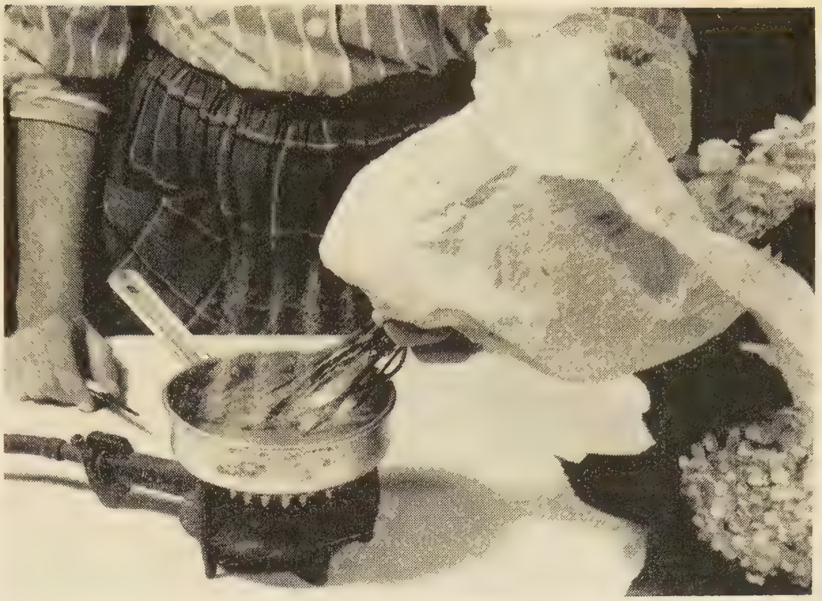
Other flowers can be cut when in tight bud and will gradually develop in water. Apart from the bulb flowers, those of trollius, oriental poppy, funkia, and many spring-flowering trees and shrubs can be treated in this way, thus increasing their useful life in flower arrangements. Roses should be cut when the first two petals are unfurling.

The petals of water-lilies, gazanias, tulips, passionflowers, and a few other lovely flowers close at night. A simple way to keep them open is to melt a little candle wax, preferably of the same colour as the petals, and put a drop or two at the base of each petal. The wax must not be too hot, as it will then damage the flower. It hardens quickly, so preventing the normal movement of the petals. If desired, the hardening of the wax can be accelerated by plunging the flower in cold water.

Flowers from vines such as clematis honeysuckle, bougainvillea, and bignonia will last longest if they are cut with a small portion of the old stem attached. Small annuals can be uprooted and the soil carefully washed from their roots.

How to Cut

A sharp knife or secateurs should be used for cutting flowers so that the plants are damaged as little as possible. This is particularly important with trees and shrubs, from which flowers and branches should be removed with a slanting cut just above an outward-pointing leaf or bud as



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Another method of dealing with flower stems which exude milky sap: Placing basal inch in boiling water for 20 to 30 seconds. The flowers and leaves must be protected from steam with tissue paper.

when pruning. Breaking off a branch or leaving a long stub often results in the dying back of the branch and the entry of disease, while careless cutting can ruin the shape and the future flowering of the shrub. The length of stem does not affect the life of a cut flower.

Many flowers are damaged between cutting and arranging, and to avoid this they should be carried a few at a time into the house and placed in water as soon as possible. Laying them in large piles in the garden and later collecting them into a big armful will crush the petals, break off many leaves, and cause a considerable amount of wilting, particularly on a hot or windy day.

If possible, take a container such as a bucket or large can partly filled with water out into the garden so that the stems can be placed in water as soon as the flowers are picked. Flowers may last a day longer if this is done. Leaves from the bases of the stems should be stripped off, as they will decay under water. Flowers with hollow stems should be cut through a leaf joint, which is not usually hollow.

When cut, flowers are severed from their normal water supply. Water continues to evaporate from the surface of petals and leaves in the process of transpiration, and water in vessels in the stem moves up to take its place. Normally this is replaced by more water lower down the stem and ultimately from the roots and soil moisture.

Driving Air out of Stems

If flowers are cut and left out of water, air is drawn into the stems instead of water and can prevent the uptake of water later, much as an air-lock in a household water system impedes flow. Flowers often wilt for this reason, even when they are subsequently placed in water. The trouble is easily remedied by re-cutting the stems to remove the basal inch which contains the air.

Another method is to place the ends of the stems in water hot enough (about 100 degrees F) to drive out the air without damaging the plant tissues. The water is allowed to cool and the stems left in it for the normal conditioning period, usually overnight. Dahlias, hollyhock, lamb's ear, mignonette, lantana, stocks, lupin, nasturtium leaves, and citrus blossom are a few which respond to this method of treatment. It is an excellent way of reviving wilted flowers.

Stems which exude a milky sap when cut, such as poppy, mallow, hollyhock, and hibiscus, are soon sealed off by the coagulation of the "milk" over the cut end. To allow water to enter the stem, the end must be treated by holding the stem in a candle flame for 15 seconds (count slowly up to 15) or by placing the basal inch in boiling water for 20 to 30 seconds. In the latter method, the flowers must be shielded from the steam.

Woody stems of shrubs, chrysanthemums, etc., need special treatment to increase the rate of uptake of water. This is most easily done by slitting up from the base an inch or two with a sharp knife. As in most stems water is absorbed only through the cut end, slitting to increase the area of cut surface is particularly important where there is a large mass of leaves and flowers on a branch. If it is not done, water absorption will not be fast enough to balance the loss of water through leaves and petals, and the latter will wilt.

An alternative method is bruising the bases of stems, but this damages tissue, which will decompose in the water.

The object of these various preparatory treatments is in all cases the same: to allow water to be taken freely through the base of the stem.

The next process is that of hardening (sometimes called conditioning), during which the stems are placed in deep cold water in a cool, dark place for at least four hours, preferably overnight. The low temperature and lack of light will reduce to a minimum the rate of water loss from the leaves and flowers, allowing them to become fully charged with water and therefore better able to withstand drying after being arranged and placed in the dry atmosphere of a room. If they are to be sent any distance—to a hospital or friend's home—they are now in the best condition.

Chemical Treatments

Various chemicals have been used in an attempt to prolong the life of cut flowers. Some, such as alum and copper are designed to inhibit the growth of bacteria which can clog the cut end of the stem, and from this arises the practice of placing a penny in a vase.

Experiments in England, Holland, and America have shown that some chemicals will prolong the life of certain cut flowers. Treatment is given during the initial hardening period before arranging.

A solution of 4 teaspoons of sugar in a quart of water is good for nigella, petunias, sweet peas, *Lychnis chalcedonica*, and delphiniums; china asters need a sugar solution double this strength.

In America it has been found that hard alkaline water reduces the life of carnations, larkspurs, roses, snapdragons, and stocks. For these flowers the water can if necessary be made more acid by adding 3 heaped teaspoons of sugar and 2 tablespoons of white distilled vinegar to a quart of water.

A little salt in the water is of benefit to begonias and coreopsis.

Large-flowered dahlias and hollyhocks can be given a pinch of potassium nitrate to each quart of water, and carnations, sweet peas, and lily of the valley may last longer if a pinch of borax is added.

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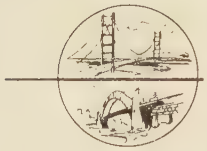

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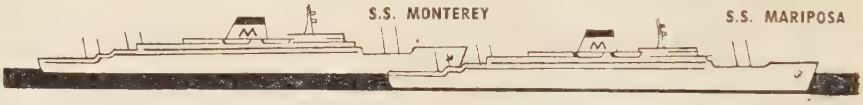

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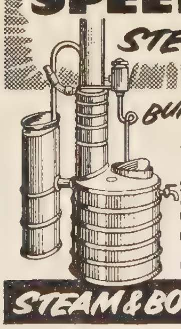

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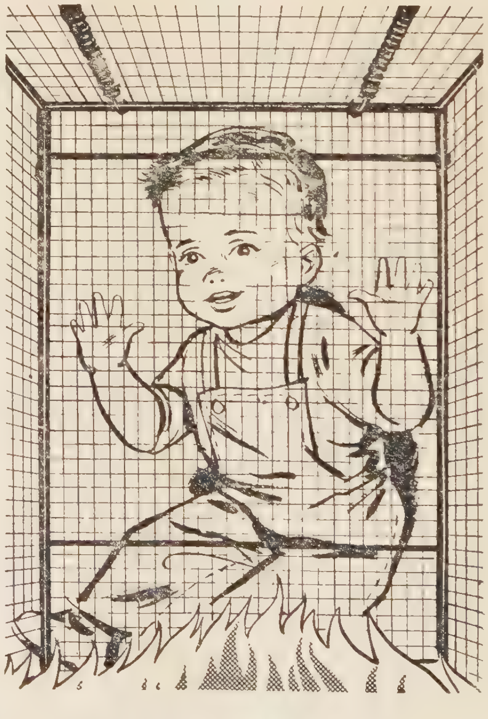

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Other mixtures which have been found useful are:

For roses and carnations: 2 gm of manganese sulphate, 1 tablespoon of sugar, and 2 teaspoons of a stock solution of hydrazine sulphate (1 oz in a quart of water) all in a quart of water.

For roses: ¼ teaspoon of alum, ¼ teaspoon of sodium hypochlorite, a pinch of ferric oxide (rust), and 2 teaspoons of sugar all in a quart of water.

The materials mentioned are obtainable from chemists or firms which specialise in chemicals. There are also proprietary mixtures.

Some difficult flowers need special treatment as follows:

Hydrangea: Cut when the head is not fully developed. Sear the end of the stalk with a flame for 15 seconds. Then submerge large heads in water until crisp. Place the stems in cold water overnight to harden. Remove surplus leaves.

Fuchsia: Pick when as many flowers as possible are fully developed on the stem. Split the ends of the stems and place in boiling water for two to three minutes. Then place in deep cold water overnight.

One hears of flowers being kept by refrigeration, but the temperature of a household refrigerator varies too much to be of use for this purpose.

Apart from the special cases mentioned, most flowers and leaves will last well if they are freshly cut in the cool of the day and stood in deep water in the dark for a few hours, or overnight if possible, before arranging. If spike flowers are allowed to wilt slightly and then placed at an angle, instead of upright, in the water, many will assume interesting curves which are so helpful when making floral designs.

After the hardening treatment, flowers can be arranged in any type of container and will last just as well in a shallow as in a deep bowl or vase.

Flower containers should be perfectly clean, because any stains left from previous use are likely to harbour bacteria, which multiply rapidly when flowers and water are replenished, causing stems and any submerged leaves to decay and give off an offensive odour. Under such conditions the cut ends of the stems are soon blocked and the flowers wilt. All containers and pinholders, netting, etc., should be cleaned with warm soapy water and a little ammonia before fresh arrangements are introduced

Rainwater is preferable to town supply water, which may be chlorinated. A lump of charcoal in the vase will help to keep the water sweet, though the vessel should still be washed each time before use.

The arrangement will remain beautiful for several days if it is not exposed to draughts or rapid changes of temperature and humidity. A low, even temperature and high humidity are best. A windowsill on the north side, which will receive the heat of the sun for most of the day, and draughts from any open window, should be avoided, as should a hallway.

Experiments have proved that the higher the temperature is the shorter will be the life of cut flowers. One type of flower kept at 50 degrees F lasted for 3 weeks; at 60 to 65 degrees, 5 to 6 days; and at 70 degrees, only 2 to 3 days.

A bowl of fruit may look most attractive beside the flowers on a table, but most flowers are sensitive to the small amounts of ethylene gas given off by ripe fruit and it will shorten their life considerably. Gas used for heating and lighting will affect flowers in the same way.

If the arrangement is placed in good light, the keeping qualities of dahlias, pyrethrum, and stocks will be enhanced. The removal of some of the leaves from flowers such as dahlia, zinnia, lilac, mock orange, and hydrangea will prolong their life.

With a little care in the choice and treatment of the cut flowers and foliage a floral decoration will remain fresh and beautiful for a considerable time.

Aphids on tulips should be sprayed with lindane or malathion to reduce the spread of tulip virus, which produces the streaking of leaves and colour "breaking" in the petals shown here. Such infected plants should be removed and burnt.

Garden Work for July

In July, the coldest month of the year in many parts of the country, soil should not be worked or planting done when the earth cakes hard or sticks to footwear. If work must be done, boards should be laid down so that the body's weight is distributed over a greater area. A mulch of sawdust placed over the area before work begins will prevent clogging.

Cloches

Cloches can give added protection to tender plants which are becoming acclimatised, and they can be used to encourage earlier growth on others. Freesias, narcissi, gladiolus, and lily of the valley can be encouraged and protected at this time. Sweet peas and other seeds can be sown now if given this added protection. Cloches should be placed over the soil to warm it at least 2 weeks before seeds are sown.

If a large number of chrysanthemums is to be propagated, cloches could be placed over the old stools now to encourage the growth of young shoots. The later-flowering types of chrysanthemums require a longer period of growth than the early flowering types and should be propagated first.

By ROSALIE A. CAMPION,
Horticultural Instructor,
Department of Agriculture,
Wellington

Basic Requirements

Seed, sprays, dusts, fertilisers, and equipment which will be required throughout the coming growing season should be bought now.

In most successful gardens it has been found necessary to apply preventive sprays or dusts against attack by pests and diseases. It is therefore necessary to have either a good sprayer or good duster and preferably both.

TARTAN

topics

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CROP PESTS

Grass Grub and Porina Caterpillar

PRODUCTS RECOMMENDED:

Mixing with seed, fertilisers:	GRUBNOX DDT "Micronized" powder
Aerial or ground application without seed or fertilisers:	TARTAN DDT Prills (refer bulletin P.15) AEROSPERSE DDT Dust
Spray application from ground or aircraft:	EMULSOL DDT Emulsion
Lawns, Bowling greens, Golf courses, etc.:	TARTAN DDT Prills D.SPRAY 50 "Micronized" wettable powder EMULSOL DDT Emulsion

DOSAGE RATES:

GRUBNOX (50% ppi DDT)	4 or 2 lbs. per acre.
TARTAN DDT PRILLS (10% ppi DDT)	20 or 10 lbs. per acre, 1 oz. to 100 sq. ft.
AEROSPERSE DDT (12½% ppi DDT)	16 or 8 lbs. per acre.
AEROSPERSE DDT (25% ppi DDT)	8 or 4 lbs. per acre.
EMULSOL DDT (20% ppi DDT)	1 gal. or ½ gal. per acre, 5 fl. ozs. in 4 gals. water per 1,000 sq. ft.
D.SPRAY 50 (50% ppi DDT)	2 ozs. in 4 gals. of water per 1,000 sq. ft.

The higher dosage shown should be used on high return pastures or wherever Porina Caterpillar is present as well as Grass Grub.

Note: If applying by watering can to small areas of lawn, dilute 1 oz. of D.SPRAY 50 or 2 fl. ozs. EMULSOL DDT to 4 gals. of water and apply at rate of 1 gal. per 100 sq. ft.

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PASTURE:

Apply from 1 to 2 lbs. **100% p.p.i.** DDT per acre according to value of pasture and period of control required. Efficiently applied the 2 lb. rate will give 3 years' control of Grass Grub and Porina Caterpillar. At the 1 lb. rate Porina control is less efficient and though control of Grass Grub is still effective the period is reduced to less than 3 years.

Apply DDT at any time of the year but preferably in the May to August period for two reasons:

(1) To control grubs before flush of spring growth and before reinfestation of pasture by egg laying adults in October and November.

(2) Rain, usual in this period, assists in dispersing DDT to an effective depth in the soil.

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The range of spray materials recommended is often confusing, but at least one general fungicide such as thiram, captan, zineb, or copper oxychloride is needed as a preventive against leaf spotting. If powdery mildew has occurred previously, either a sulphur or karathane spray should be kept for use.

At least one general insecticide is needed. Some of the most useful are malathion, lindane, and DDT. If scale insects are troublesome on evergreens, summer oil should be obtained.

Many so-called complete fertilisers are available, but balanced fertilisers can easily be mixed from such materials as sulphate of ammonia, blood and bone, superphosphate, and sulphate of potash.

Frosts

Half-hardy plants, if given some protection in the early stages, can sometimes be established in districts which have light frosts. Three stakes placed round a plant over which a large polythene bag or tube is placed will give neat protection. Scrim could be used.

Hydrangeas and geraniums should not be cut back until danger of frosts is over. The old blooms and leaves give some protection to the lower buds, which may be damaged if fully exposed. Plants which have recently been set out should be firmed after severe frosts, which may lift them from the ground and loosen the roots. If possible, heavy clay soils should be dug over and left rough to be broken down by frosts.

Hedges

Perennial weeds such as couch, sorrel, and oxalis should be eradicated before any hedge planting is done. Couch is best dug out of the soil, as the digging will at the same time improve the soil for planting. Dalapon or TCA can be used to control couch, but planting must then be delayed two weeks and six weeks respectively after application. Sorrel can be removed only by digging.

Oxalis-infested areas can be treated with vapam, but as this must be done in summer, planting of the hedge will have to be delayed for a season.

Hedges will establish better if a balanced fertiliser is well mixed with the soil in the root area.

A number of hedges, including cotoneaster, privet, nothofagus (native beech), and tamarisk can now be pruned.

Trees and Shrubs

Shrubs which will flower on wood to be grown this spring, such as *Spirea japonica*, ceanothus of the deciduous hybrid type such as Marie Simon and Gloire de Versailles, *Clematis jackmani*, *Buddleia variabilis*, and *Erythrina crista-galli* (coral tree) should now be pruned to encourage good flowering growths and to prevent the base becoming bare and straggly. *Ceratostigma willmottianum*, a small blue-flowered shrub which is attractive for a long period in summer, can now be pruned down to ground level.

The old dead fronds of tree ferns should be cut off to give a neat general appearance. Shrubs can be mulched with compost or sawdust later in spring to keep the roots cool in summer, conserve moisture, and check growth of weeds.

When choosing plants, consider those which add interest or colour during winter when flowers are scarce.

If the soil in the planting area is very heavy, the whole of the area should be dug before planting so that the digging of individual holes does not create sumps into which the water will drain to the detriment of the new roots. On poor soils compost plus a large handful of a mixture of 4 parts of blood and bone and 1 part of sulphate of potash should be mixed with the filling-in soil.

[Orr

Cloches can be used to protect boxes of young seedlings. This size (24 in. x 23 in.) is large enough to cover two ordinary-size seed boxes and is easy to shift about the garden.

Roses

Planting of rose bushes should continue. If the plants are at all dry, the roots should be soaked in a bucket of water for 2 or 3 hours before planting. Any damaged roots should be pruned neatly before planting and the roots spread out in a natural position with the plant set so that the bud union is at, or just below, ground level.

Newly planted rose bushes should be pruned by cutting the strong young growths back to good outside buds 8 to 12 in. from the ground. Any badly crossed branches or weak, spindly twigs should be removed.

On established rose bushes dead, diseased, and damaged branches should be cut out. On bushes which have made plenty of young growth from the base last season, older flowering branches should be removed and the young wood lightly pruned, about a third of the growth being removed. Healthy bushes which made little new growth last season may need food, which should be provided in early spring. These plants should be pruned more severely than plants which are making strong growth.

All prunings and dead leaves should be raked up and burnt and roses then sprayed with winter oil (1 3/5 pints to 4 gallons of water) to kill scale insects.

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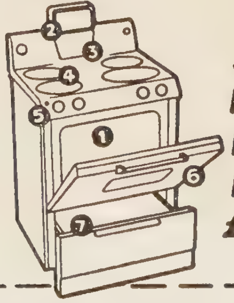

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Prevalent Insects

In milder districts aphids may be evident on polyanthus, tulips, cinerarias, and other plants. Sprays of lindane or malathion should be used to destroy these insects, which beside sucking the sap from the plants spread virus diseases such as tulip-breaking and narcissi viruses.

Subterranean caterpillar damage often occurs at this time. The caterpillars, which come to the surface at night and feed on vegetation, leave holes in the soil about the thickness of a pencil. If these are noticed, the whole garden, including lawn and flower beds, should be treated with 50 per cent DDT at 1 oz to 40 sq. yd.

Several scale insects including San Jose, golden oak, and rose scales may be present on shrubby material, and oil sprays should be used to kill them. On deciduous plants winter oil can be used, but on evergreens summer oil should be applied.

Slaters (woodlice) can cause considerable damage and all sheltering places, such as boxes, boards, and old sacks, should be cleaned up and the infested areas treated liberally with DDT dust. If slugs and snails are troublesome, baits containing metaldehyde should be placed about the garden.

Border Plants

When soil conditions permit many border plants, including hemerocallis and gaillardias, can be divided and replanted. *Gentiana acaulis* can be divided and planted firmly in a limed soil where conditions tend to be cold in winter and hot in summer.

Leaf spotting is likely to occur from now on on many plants including polyanthus, violets, and carnations. Infected leaves should be removed and the remainder of the plants sprayed with a fungicide.

Cyclamen neapolitanum should have finished flowering by now. Mature seed from it can be collected and planted in a shady position. Plants can be transplanted now into semi-shady positions such as under deciduous trees.

Lawns

An acid soil encourages the growth of the desirable, finer lawn grasses. To create this condition and feed these grasses, regular applications of a mixture of 3 parts of sulphate of ammonia and 1 part of superphosphate should be made at 1 oz per square yard.

In the preparation of new lawns this mixture should be raked in with the seed. If applied at 3-monthly intervals thereafter, it will discourage weeds while encouraging the finer grasses. DDT (50 per cent) at 1 oz to 40 sq. yd. can be included with the fertiliser to control grass grubs and subterranean caterpillars.

Moss is usually attributed to shaded wet soils, but an even greater contributing factor is poor fertility. Moss areas can be treated with sodium pentachlorophenate at 1 oz to 40 sq. yd. followed by topdressing with the fertilisers already mentioned and reseeding.

Lawn areas which have become heavily compacted should be aerated by piercing with a fork. Soil preparation for spring sowing of new lawns should be continued.

Two types of rust on geraniums, a disease which is likely to be prevalent now on rooted cuttings held in cold frames.

Plants under Glass

Plants growing under the artificial conditions produced in a glasshouse require constant checking at this time. It is easy to create conditions which are too hot and wet without sufficient free circulation of fresh air. Plants should not be overwatered and except on the worst winter days some ventilation should be given during the warmest part of each day.

Glass frames or coverings on seed boxes should be lifted each day and the condensed moisture wiped off. If these beads of moisture drop, they are likely to cause sufficient localised humidity to induce damping-off. Any decaying plant material should be picked off immediately to prevent a build-up of fungi.

If greenfly are prevalent, the glasshouse should be fumigated twice at an interval of 10 days.

Cold frames should be opened up in the mornings whenever possible, but should be closed again in mid-afternoon to trap the heat of the day. At this time of the year geraniums under glass are often badly attacked by rust. Zineb sprays should be applied at the first sign of the brown pustules under the leaves.

Cuttings of perpetual-flowering carnations can now be taken. Bushy side shoots make the best plants. The bottom leaves, which will be under the rooting media, should be removed and the bases of the cuttings dipped in a rooting hormone to hasten root development.

General

Seed of the slower-growing annuals can now be sown under glass so that they will be ready for planting out in late spring. These include 10-week stocks, nemesia, lobelia, *Begonia semperflorens*, torenia, antirrhinums, gaillardias, verbenas, and pansies. If heat is available, seed of *Salvia farinacea*, chaubard and marguerite carnations, asparagus, gloxinia, cyclamen, tuberous begonias, and saintpaulias can be sown.

In warmer positions outdoors, annuals can be sown. Those sown in the border in autumn should now be thinned to 8 to 9 in. apart.

Bulbs in pots should be watered sparingly until the flower buds appear, after which watering can be increased.

Wood ashes should be stored under cover until needed for plants requiring special dressings of potash. They also contain a high proportion of lime and therefore should not be used on rhododendrons, ericas, liliums, and azaleas.

Root cuttings of oriental poppies, anchusa, and eryngium can be taken, but only from the most healthy and vigorous plants. Streptocarpus plants can be transplanted into larger pots and old plants divided.

Iceland poppies should be examined for symptoms of tomato spotted wilt virus, which shows as stunting, distortion, and mottling of the leaves. Infected plants should be removed and burnt.

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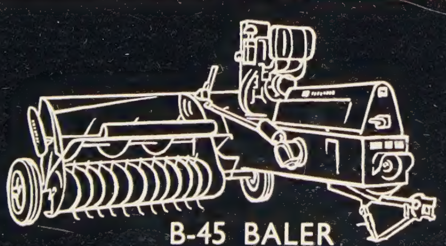
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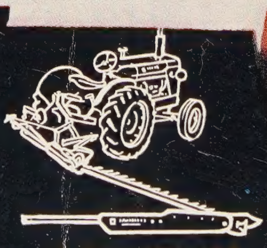
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